MAY
1946

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Repairing Cuts in Pavements

Preventing Fly-Breeding in Sludge

Classification of Water Supplies

Public Works

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PUBLIC ROADS ADMINISTRATION
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FRED STUART and AL BRUMLEY ARE LEARNING THE ALPHABET!

They've learned . . . as many of the country's outstanding waterworks engineers know . . . that

"A" is for ACTIVATED ALUM!

The alum which forms a quick and efficient floc . . .
The alum which is acid-treated with H_2SO_4 . . .
An insoluble silicate which forms a tougher, faster settling floc . . .
The alum which is ground to a size that permits 100%
to pass through a sieve with 10 meshes per linear inch!

"B" is for BLACKALUM!

It's also activated, with TEN TECHNICAL ADVANTAGES FOR YOU!

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2. Faster settling floc
3. Stabilization of sludge
4. Stabilization of filter sand
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6. Bacterial count reduced in filtered water
7. Less free residual alum in finished water
8. Chlorine demand reduction
9. Dechlorination
10. Taste and odor improvement

AND . . . A LITTLE LATER . . . THEY'LL COME TO THE "E's" . . . THE REVOLUTIONARY METHOD OF WATER PURIFICATION . . . BY ELECTRONICS!

The Electronic Water Purifier . . . Soon!

STUART-BRUMLEY CORP.
516 N. CHARLES ST. BALTIMORE, MD.

BIG HELP...

In Bell and Spigot Main Jointing

This simple, wedge-shaped rubber device helps in these important ways

✓ Prevents Recontamination

Rubber cannot harbor bacteria nor support their growth internally where water main sterilizing agents cannot reach. Use of Hyde-Ro Ring prevents continued recontamination, so often traced to joint packing.

✓ Makes Repeated Hypochlorite Flushings Unnecessary

Your first hypochlorite flushing will invariably secure negative reaction.

✓ Saves Water Waste

With tight seal more quickly secured, water waste is cut 'way down.

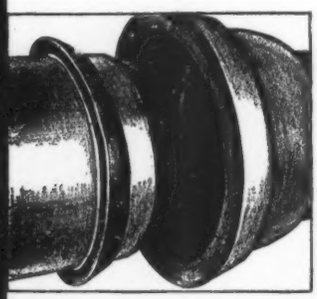
✓ Facilitates Repairs

Caulked tightly into place; the Hyde-Ro Ring dams off water from leaking valves and permits pouring of dry joints.

✓ Saves Its Cost Over and Over

The cost of HYDE-RO Rings is insignificant compared to that of repeated hypochlorite treatments, or the expense of sterilizing and keeping sterile *(if it can be done)* other types of packing.

EASILY INSTALLED



No measuring or cutting. You can't use the wrong size. Being solid, ring has no laps to take up joint space. Same ring fits straight or beaded end pipe. Your narrow caulking iron slips automatically into groove in back. Conveniently packaged—cartons of fifty rings; compact, light in weight; easily handled and stored.

Sizes available for 4, 6, 8, 10 and 12" cast iron pipe. Works with *Tegul*-MINERALEAD, Portland Cement or lead. For further information, write us at Mertztown.

YOU'LL ALSO WANT A GOOD JOINTING COMPOUND

You'll get • Reduced initial leakage • Ease of handling and working • No trouble from premature wetting • Tight joints of *much* higher resistance to mechanical and thermal shock . . . and other advantages in

Tegul-MINERALEAD — *The Ingot Form Compound*

THE *Atlas Mineral*

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*SALT LAKE CITY 11, Utah, 1212 So. State St.
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WITH CHICAGO "PACKAGE" PLANTS

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OVER 100 IN SUCCESSFUL OPERATION LAST 12 YEARS

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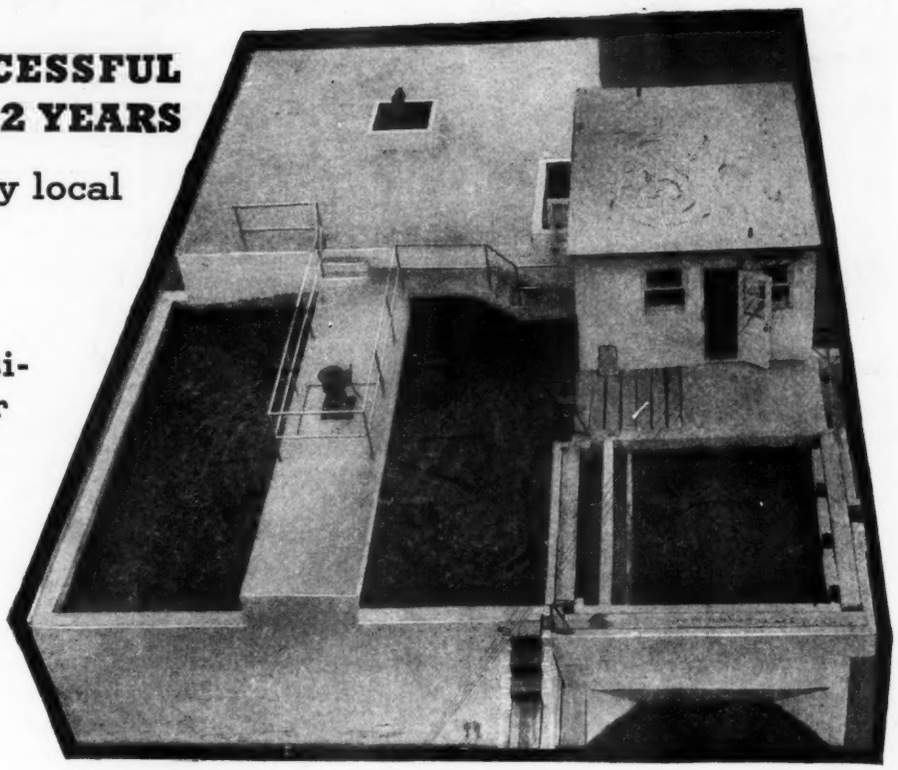
- Located close to residences without odor or fly nuisance
- Eliminates long interceptor
- Neat in appearance
- Space saving
- Produce sparkling clear effluent

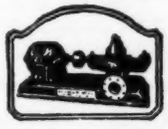


Chicago "Package" Sewage Treatment Plant at the Consolidated Vultee Aircraft Corp., Miami Springs, Florida. The primary tank is in the right foreground. Behind it is the pump house. Left foreground is the Combination Aerator-Clarifier. Aeration and clarification are performed in this single tank. Behind it is the digester.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2348 WOLFRAM STREET **CHICAGO 18, ILLINOIS**



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Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

VOL. 77 PUBLIC WORKS No. 5

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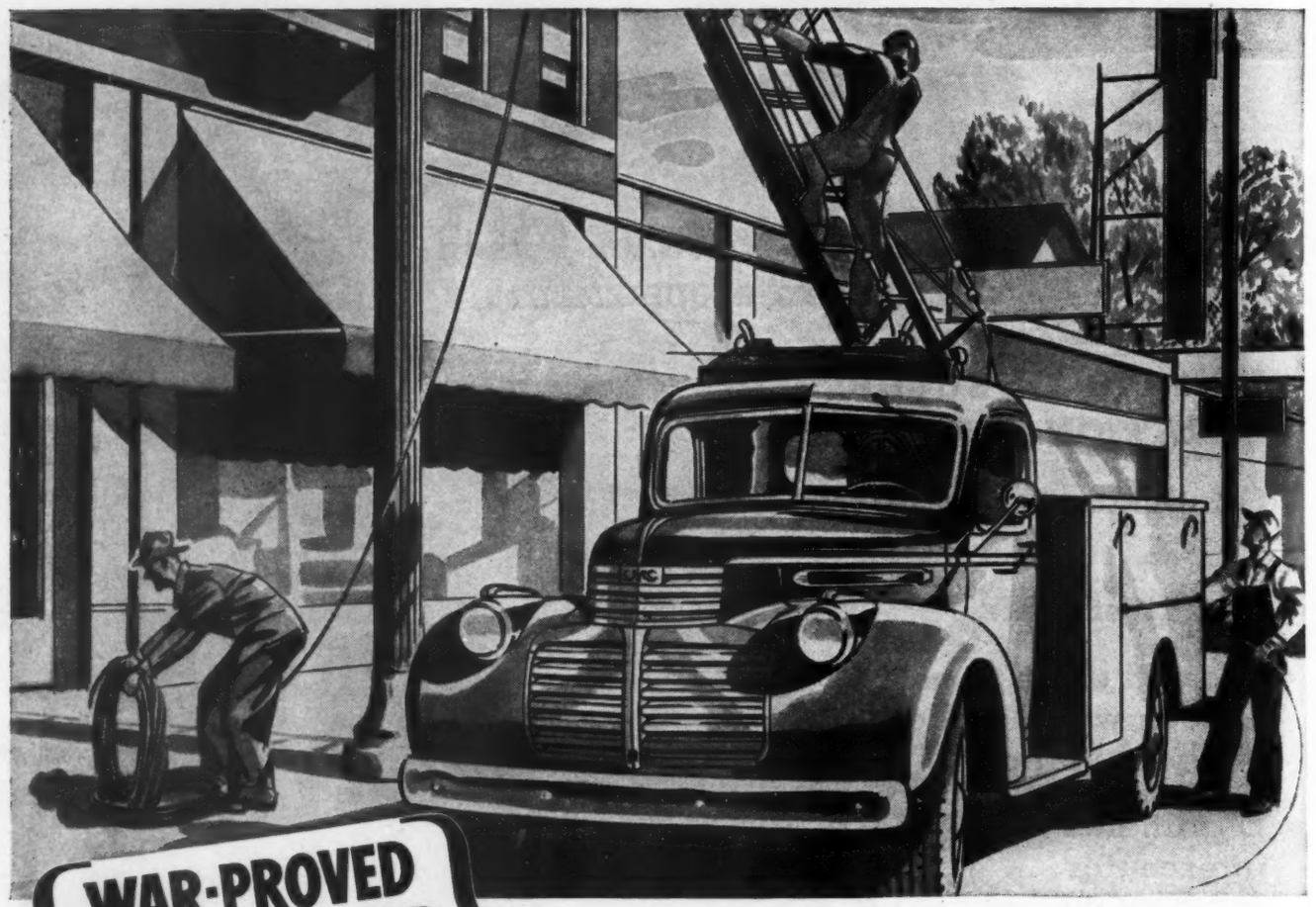
MAY, 1946

NEW GMCs for Public Utility Use



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- Powerful, economical "Army Workhorse" engines of Valve-in-Head design with Tocco-hardened Crankshafts, Airplane type "Durex" Main Bearings, Heat-resisting Exhaust Valves with improved Valve Seat Inserts, Positive Crankcase Ventilation, Turbo-Top Pistons and Full Pressure Lubrication through Rifle Drilled Connecting Rods.
- Rugged, built-for-the-job chassis with extra strong Frames, Springs and Axles, heavy duty Transmissions and Clutches, Needle Bearing Universal Joints, Recirculating Ball-Bearing Steering and powerful, easy-action Brakes.
- Rider Ease Cabs with Cradle-Coil Cushions, Wide Visibility "V" Windshields, Quick-vision Instrument Panels, All-Weather Insulation and Controlled Ventilation.

New GMCs offer you the most in public utility truck value in a most complete selection of models. There are pick-ups in several sizes for light hauling and emergency work. There are conventional and cab-over-engine models in tonnage ranges and chassis options to accommodate every kind of special installation and repair equipment. And there are heavy duty gasoline and diesel powered chassis for pole hauling and setting, garbage disposal, fire equipment, all types of civic service and construction. It will pay you to investigate GMC. For, whatever your hauling requirements . . . from ½ to 20 tons . . . you'll find a war-proved, improved GMC truck ideally suited to each individual job.

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GMC TRUCKS

GASOLINE DIESEL

GMC TRUCK & COACH DIVISION • GENERAL MOTORS CORPORATION

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By Col. W. A. Hardenbergh

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WATER SUPPLY AND PURIFICATION covers clearly and concisely the principles involved in selecting the best source of water supply, estimating the probable quantity of water that can be obtained from a source, providing pipes and accessories for delivering water to the consumers, and determining the capacity of each part of a distribution system. The book also describes in detail the various methods of treating water so that it not only will be satisfactory from the stand-point of public health but will be soft, clear, and palatable as well.

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Vol. 77 No. 5

W. A. HARDENBERGH and A. PRESCOTT FOLWELL
Editors

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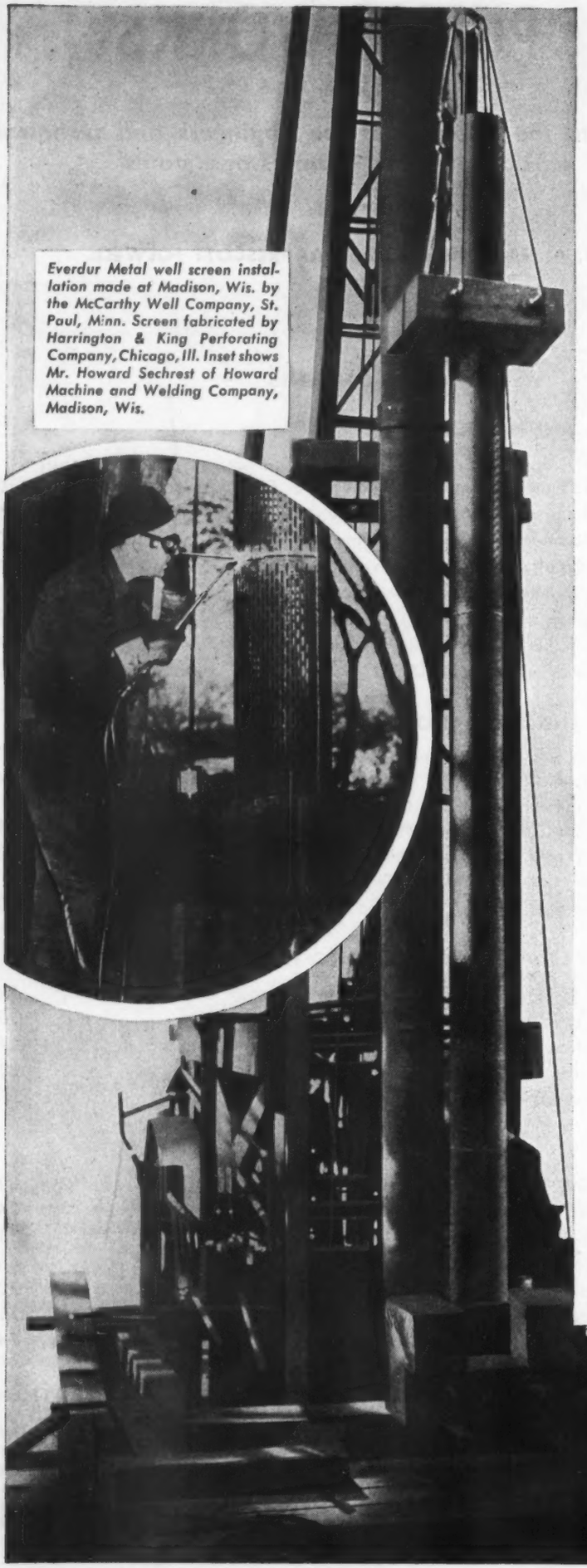

Everdur Metal well screen installation made at Madison, Wis. by the McCarthy Well Company, St. Paul, Minn. Screen fabricated by Harrington & King Perforating Company, Chicago, Ill. Inset shows Mr. Howard Sechrest of Howard Machine and Welding Company, Madison, Wis.

270-Ft. EVERDUR Screen puts new life into Old Well . . .

BECAUSE of repeated cave-ins, one of the wells operated by the Water Department of the city of Madison, Wisconsin, had to be taken out of service. Service was restored by installation of a well screen of Everdur* Metal.

States Mr. L. A. Smith, Superintendent, "It was clear that the life of the well would be dependent upon the life of the screen. The material finally selected was Everdur Metal, the life of which was estimated to be at least 25 years."

The accompanying photographs show installation of the Everdur screen . . . 20 lengths totaling 270', 12" dia., ⅛" thick with slots 1½" long x 3/16" wide.

For waterworks and sewage treatment equipment Everdur Copper-Silicon Alloys have proved to be highly versatile. Combining the corrosion resistance of copper with high strength and weldability, they make possible lightweight construction, assure long, economical service.

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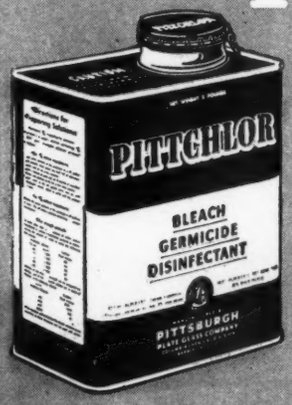
PITTCHLOR



You can bid goodbye to chlorine-susceptible microorganisms, bacteria and algae in water supplies when you use Pittchlor—the high-test calcium hypochlorite containing a minimum of 70% available chlorine. Used for sewage treatment . . . for disinfection, deodorizing and general sanitation, Pittchlor proves highly effective.

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No special equipment or expensive installations are required for most uses. Solutions of desired strength for numerous applications can be made quickly when needed . . . write for descriptive literature.

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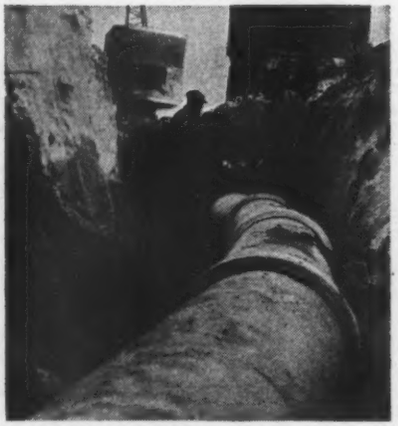
UNDER CITY STREETS, Transite saves by permitting narrower trenches, reducing disturbance to pavement. Fast assembly minimizes traffic tie-ups.

IN AGGRESSIVE SOILS, Transite guards against destructive corrosion. Thousands of installations prove its stability under a wide range of conditions.

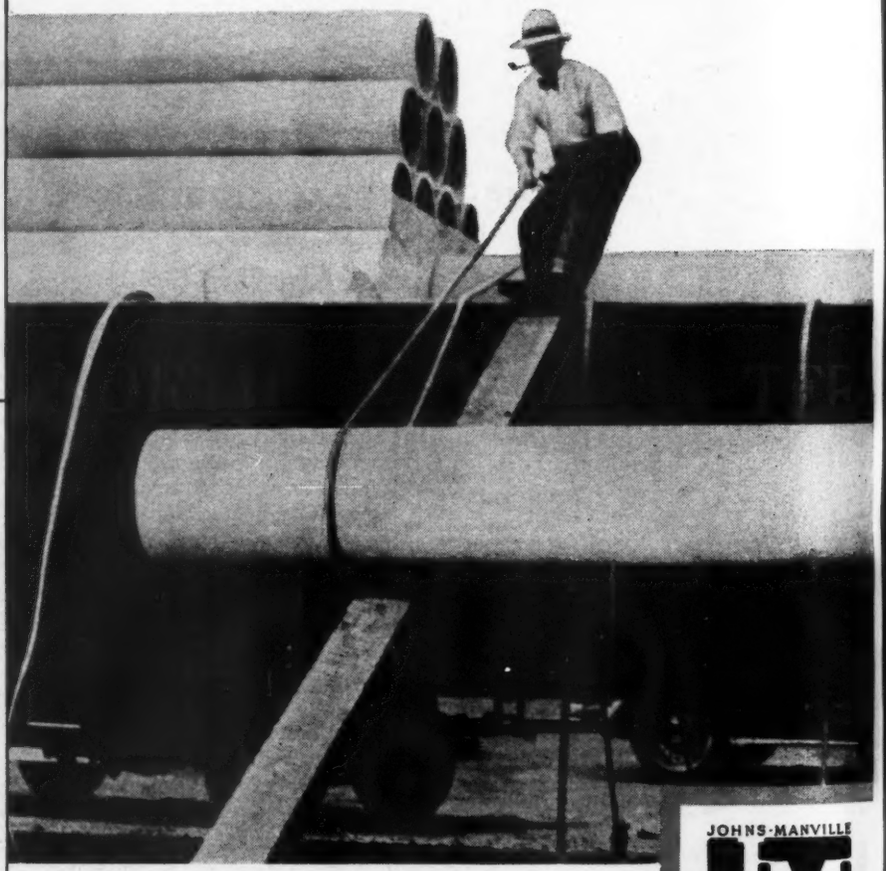
IN THE TRENCH, man-hours are cut. Fewer men are needed for handling. Most sizes can be installed without mechanical handling equipment.



IN SUPPLY LINES, Transite's immunity to tuberculation means lower pumping costs. Its high flow capacity (C=140) is tuberculation-proof.

AS DISTRIBUTION MAINS, Transite Pipe cannot cause "red water." Its high corrosion resistance means low maintenance over the years.

Wherever it's used . . .



AS YOU CAN SEE—Transite Pipe is unusually light in weight . . . easily handled and unloaded. Installation takes less time . . . and fewer men.

JOHNS-MANVILLE JM PRODUCTS

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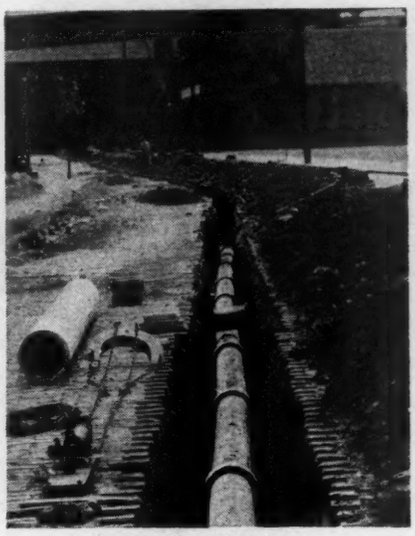
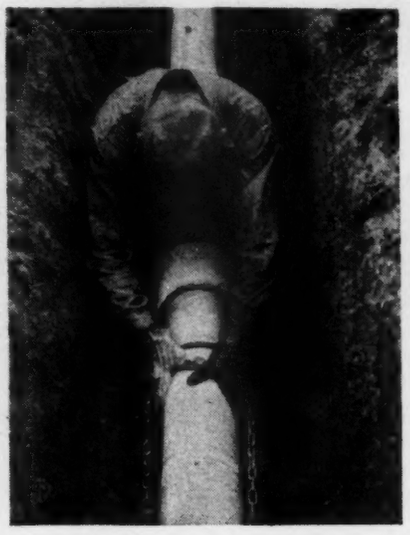
ON CURVES and in hilly terrain, Transite Pipe's flexible Simplex Coupling permits up to 5° deflection at each joint without use of fittings.

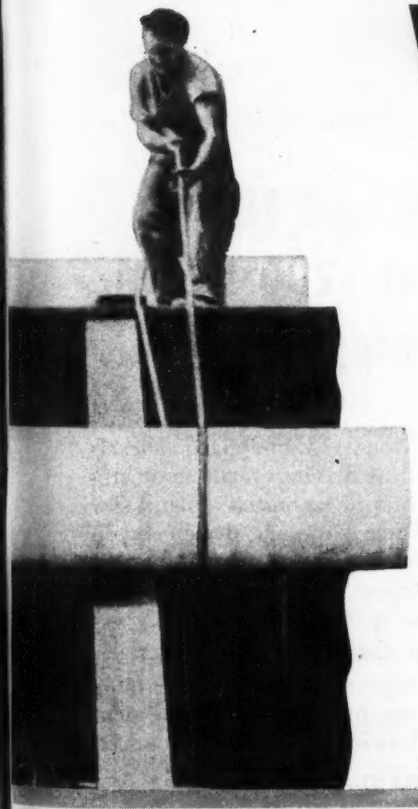


UNDER HEAVY TRAFFIC the Simplex Coupling provides a flexible joint that effectively withstands vibration—absorbs the shocks of heavy vehicles.



AT THE JOINTS, Simplex Couplings mean quick, easy assembly. They safeguard against underground leakage and undermining of supporting soil.

TRANSITE PIPE HOLDS DOWN WATER LINE COSTS



WITH an eye to *future economy* as well as *present-day efficiency*—thousands of forward-looking communities are using TRANSITE PRESSURE PIPE—in both water transmission and distribution lines.

Made of asbestos and cement, this tough durable pipe saves installation, operating and maintenance costs.

Light in weight, it is easily handled. The Simplex Coupling permits quick assembly . . . forms tight yet flexible joints. Highly corrosion-resistant, this modern pipe withstands aggressive soils. Because Transite's high carrying capacity (C=140) can never be reduced by tuberculation, pressures are higher, pumping costs lower . . . an added margin is provided for future water needs.

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Develop 16 and 18 Continuous H.P. at 1200 R.P.M. —Fully Equipped

Designed to fill gap in Sheppard 3¾ to 56 H.P. range

THE new model 13 series combine the compactness of the Sheppard Model 7, 8 H.P. engines with the high power output per cubic foot of the Model 6, 25 H.P. units.

Included in their design are all the advanced engineering features found on every Sheppard Diesel.

Removable, wet-type cylinder liners . . . oil-spray-cooled pistons . . . full pressure lubrication . . . full floating piston pins . . . are just a few. The exclusive Sheppard fuel injection system insures easy, sure-fire starting because it was developed with the Sheppard engine—not adapted to it.

The 2 cylinder Model 13 engines . . . like all other Sheppard Diesels . . . are of the full Diesel, solid fuel injection type with compression ignition. No special starting devices . . . no electrical ignition . . . no carburetor to maintain and service. 24 volt electric starting motor, power take-off and clutch are standard equipment on both engines.

The Model 13 Sheppard Diesels are ideal for driving portable or stationary pumps, compressors and saw mills. Their compact design facilitates handling and assures maximum H.P. output per cubic foot of installation space.

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DIESEL'S THE POWER . . .

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Power Units, 3¾ to 56 H.P. • Generating Sets, 2,000 to 36,000 Watts

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Two turbulent mountain streams meet, roiled up with dirt and algae drained from mountain swamps. A few miles downstream there's a plant requiring thousands of gallons of water daily . . . but water that must be clean and pure. Before this water reaches the plant, it will need a bath.

If clean, pure water is a manufacturing must, or would improve your products, let SOLVAY Liquid Chlorine "wash" your water for you. Water with SOLVAY is germ-free and clean.

Are you having trouble with water? Let SOLVAY experts show you how to give it a regular Saturday night bath, before it gets into your plant. Write to Technical Service Department.

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MECHANICAL
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MIXING EQUIPMENT

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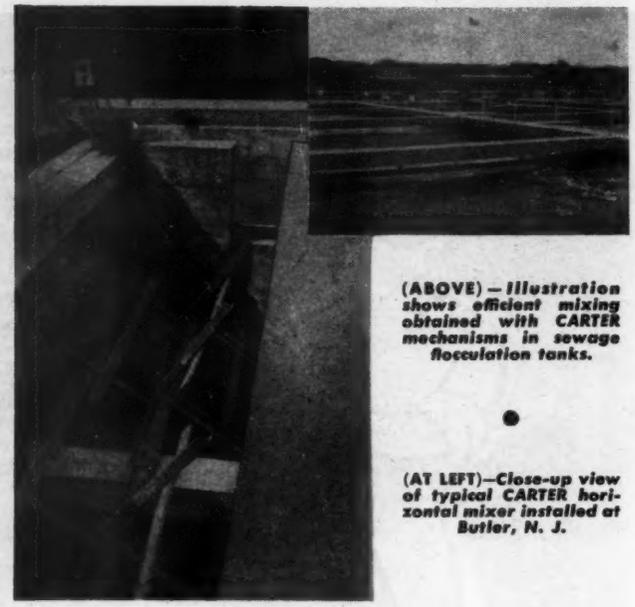

(ABOVE)—*Illustration shows efficient mixing obtained with CARTER mechanisms in sewage flocculation tanks.*

•

(AT LEFT)—*Close-up view of typical CARTER horizontal mixer installed at Butler, N. J.*

For flocculation or pre-flocculation prior to settling, CARTER custom-built mixing equipment operating either independently or in conjunction with air, materially aid the coagulent by promoting floc amassment at a velocity just sufficient to prevent sedimentation.

May we recommend the services of one of our engineers to assist you on your next design—no obligation of course.

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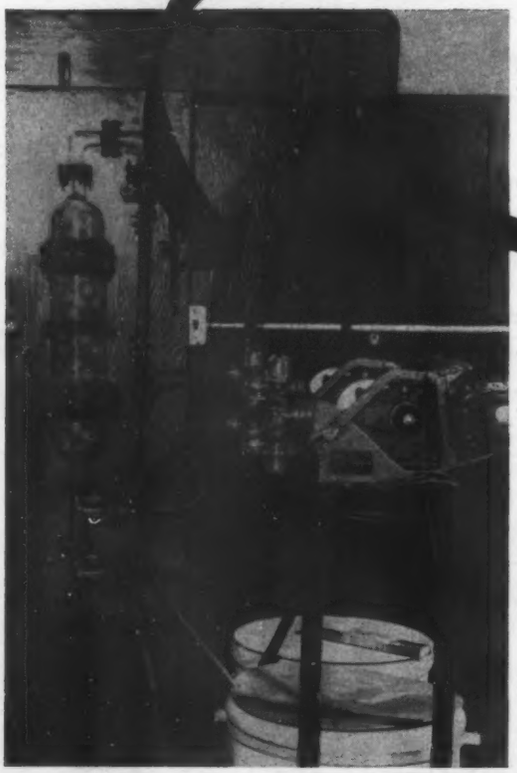
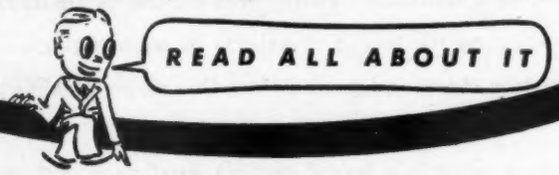
HEAVY DUTY MIDGET CHEM-O-FEEDERS MAKE POSSIBLE WIDESPREAD USE OF CHLORINE DIOXIDE TREATMENT





★ The new Chlorine Dioxide treatment, successfully used for prevention of so-called "chlorinous" tastes due to excessive algae and organic matter, is now available to both small and large communities through use of %Proportioneers% Chem-O-Feeders. At The New Rochelle Water Company's Pocantico Pumping Station the water supply of about 3,000,000 gals. per day is chlorinated to breakpoint with 3 to 5 P.P.M. and, after retention, is put through pressure filters, leaving residual chlorine of .3 P.P.M. For taste and odor control, a solution of Sodium Chlorite is pumped from a 20 gal. crock, as shown, into a Chlorine Dioxide Generator by a Heavy Duty Midget Chem-O-Feeder and combined with chlorine solution to form Chlorine Dioxide. The Chlorine Dioxide is carried into the suction line by rubber hose.

★ The Heavy Duty Midget Chem-O-Feeder is set at lowest belt speed and a cam setting of 2 on the indicator gives correct feeding rate. Stand by equipment is provided for continuous operation. Residual chlorine leaving the plant is maintained at .5 P.P.M. minimum.

★%Proportioneers% can solve your water treating problem. Write for information.

%PROPORTIONEERS, INC.%

96 CODDING STREET, PROVIDENCE 1, RHODE ISLAND

MORE FORD TRUCKS ON THE *JOB!*

They're Built to Spend *LESS TIME IN THE SHOP!*

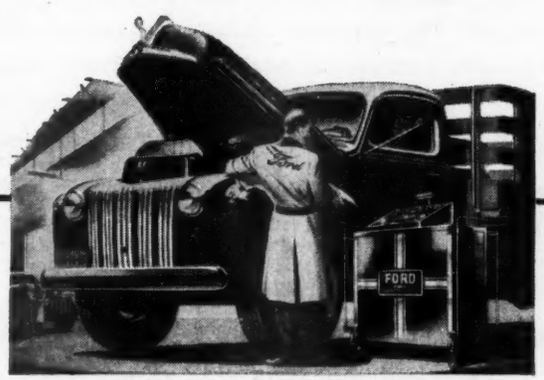
Ford

Your trucks can earn money for you *only* when they're on the job. Ford Trucks are engineered for extra endurance. They're tough, sturdy and renowned for reliability. *They stay on the job!*

And when your Ford Truck *does* need service, the time and cost are usually less, because a Ford Truck is easy for a man to work on. The nation-wide Ford Dealers' Parts Exchange Plan, too, saves you time and money on unit-assembly replacements.

Wherever your trucks travel, in big towns or small, you'll find economical Ford service, with trained men and ample stocks of genuine, sure-fitting Ford parts. Ford truck service is geared to cut "off-the-job" time, keep your trucks on the road and protect your delivery schedules.

Doesn't it strike you that such a line-up of extra value merits a call on your Ford Dealer soon?



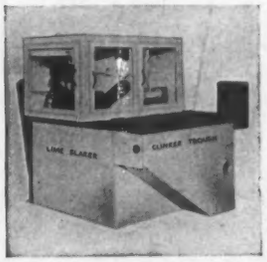
FORD TRUCKS

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 71-73*

OMEGA

LIME FEEDERS AND SLAKERS WOULD WORK FOR YOU, TOO!

Free yourself from the worries of lime feeding and slaking! Omega Gravimetric feeders are fully automatic, with alarms to call you the instant anything is wrong. No calibration is required—the feeding rate can be preset to deliver the exact amount required, and feeding accuracy is maintained within 2%. The Omega lime slaker does a thorough job; its high speed mixers promote complete slaking. Advanced design incorporates thermostatic heat control, efficient insulation, vapor removal devices and heat exchanger coils.



Omega Belt Type Gravimetric Feeder and 500 lb./hr. Omega Slaker. Weighs material continuously on a short conveyor belt carried on sensitive scales. Slakers can be furnished to handle from 175 to 10,000 pounds per hour. Omega Volumetric Feeders are available for use where quantities fed are small and gravimetric accuracy is not required.

Write for Bulletin 5-8

OTHER OMEGA PRODUCTS

Volumetric Feeders—Disc Feeders, Solution Feeders, Rotodip Feeders, Rotolock Feeders.
Dust Removers and Bucket Elevators.

OMEGA MACHINE COMPANY

(Division of Builders Iron Foundry)

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Case History No. 7

WM. H. SCHNEIDER,
Supt. and Chemist
Water Filtration Plant,
Fremont, Ohio

A SOFTENING PLANT

"The City of Fremont, Ohio, located on the Sandusky River in North Central Ohio, in the year of 1928 designed and built a water softening plant to handle 3,000,000 gallons of water per day. The plant was planned to soften and purify the very flashy Sandusky river water, with a turbidity reaching 3,000 p.p.m. and hardness up to 660 p.p.m.

"The plant was of a conventional design, employing Lime and Soda Ash for softening and Alum for coagulation. Trouble was encountered in forming a satisfactory floc in the colder months, especially with high turbidities. As the city grew and the demand increased, it was necessary to find a remedy for this condition, and after running laboratory tests indications were that an iron salt would give better results. An old feeder was converted so as to make it possible to run a plant scale test, using FERRI-FLOC.

"The conclusions reached from this plant test prompted our purchasing new feeding equipment suitable for feeding FERRI-FLOC. As a result of this change, we have secured a more satisfactory finished water throughout the entire year.

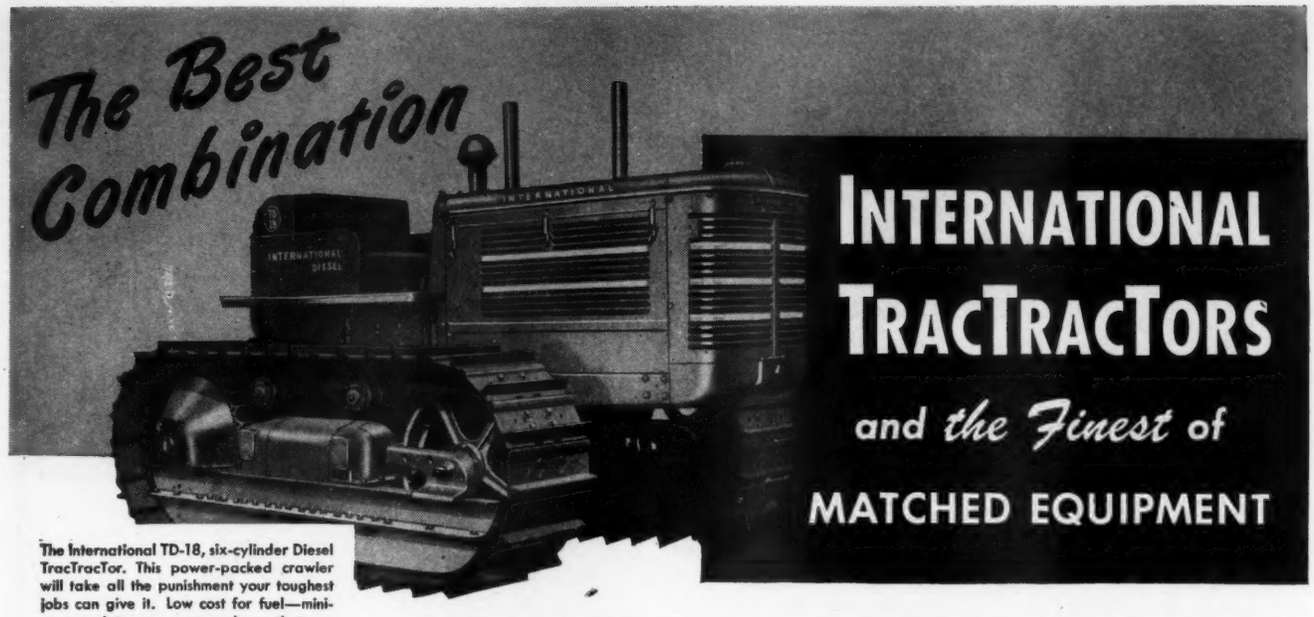
"Our thanks to the Technical Staff of the Tennessee Corporation for their assistance in solving our problem."

(Signed) WM. H. SCHNEIDER

TENNESSEE CORPORATION

Manufacturers of Ferri-Floc

ATLANTA, GEORGIA LOCKLAND, OHIO



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and the Finest of MATCHED EQUIPMENT

The International TD-18, six-cylinder Diesel TracTracTor. This power-packed crawler will take all the punishment your toughest jobs can give it. Low cost for fuel—minimum maintenance—ruggedness that assures long-lived service in powering the construction jobs of today and tomorrow—backed by International Harvester's world-wide service organization.

ONE outstanding advantage in buying International Tractors for any power application is the excellence of perfectly matched equipment available for use with them. Through International Industrial Power distributors you have available the 'dozer blades and other earth-moving tools that are best adapted to the work at your locations.

Thus, you have the best combination for profitable operations: (1) the unbeatable operating economy of power-packed International Crawlers and (2) the finest of time-tested and job-proved equipment, matched in work capacity to the horsepower of International Tractors.

Consider the many superior features of International Diesel TracTracTors, such as:

- Instant-starting, *full Diesel* engines with advanced design fuel injection that assures complete fuel combustion—
- Ball-bearing and roller-bearing power transmissions that deliver maximum engine horsepower to the tracks—
- Accessible and replaceable clutches, brakes, transmission and other assemblies—

Then you know that International Tractors plus the finest of matched equipment makes the best combination for greater profits through peak performance.

See your International Industrial Power Distributor for all the facts about International Tractors, Power Units and matched equipment now available. There's a size and type of International Tractor exactly suited to your operations.

Industrial Power Division

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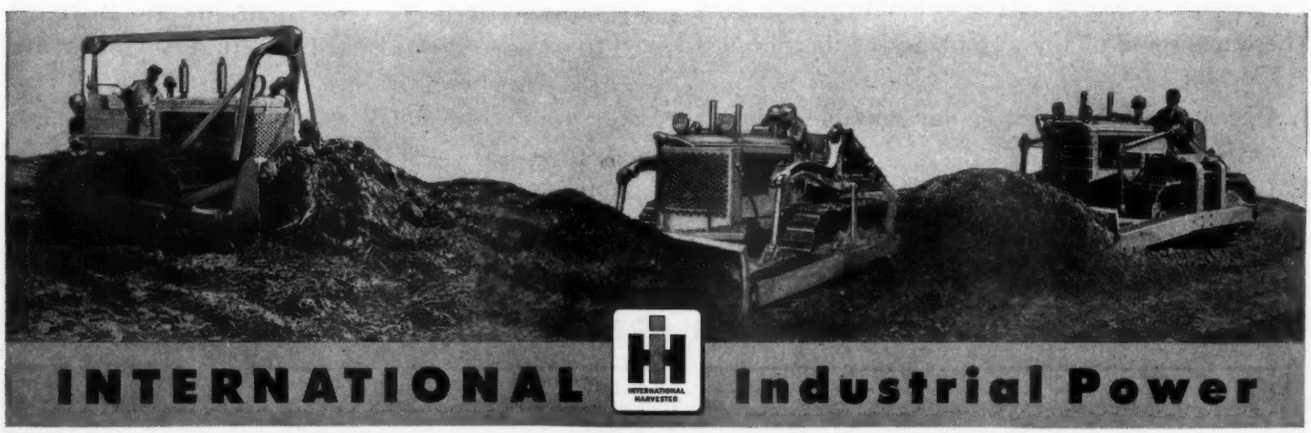
Dependable after-sale service is provided all owners of Internationals by distributors and dealer organizations that span the continent and circle the globe. Factory replacement parts and equipment built for use with International Tractors and Power Units are available through these organizations. This assures maximum value and long term benefits for owners, and operators everywhere



When you need special information—consult the classified **READER'S SERVICE DEPT.**, *pages 71-73*

ACCURATE FLOW MEASUREMENT *at LOW COST* THE SIMPLEX MS METER

This low cost Simplex instrument meets the high standards for accuracy, sensitivity and dependability required in measuring flow rates in water and sewage, as well as in power and process plants.

These are some of the advantages of the Simplex MS Meter:

1. Operates efficiently with any suitable primary device.
2. Is installed and maintained economically.
3. Rugged, trouble-free construction.
4. Accuracy over entire flow range.
5. Simplex bell-shaped float which translates the half power of the differential into uniform graduations of chart and dial.
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Complete data is now available in Bulletin 350 — straight-forward, factual information with drawings, charts, and test data. Write for your copy today — specify the Simplex MS Meter in tomorrow's planning.

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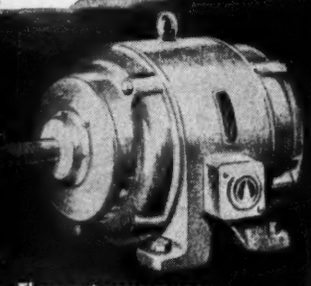
When you need special information—consult the classified READER'S SERVICE DEPT., *pages 71-73*

It's a family matter!

Yau can bring the widest variety of problems about fluids-moving to Fairbanks-Morse—*and keep them in the family!* Here's a single source—world-known and pump-wise—of proved pumping equipment, including the largest to the smallest centrifugals, vertical turbines and a broad line of special application types.

WHY NOT place your pumping difficulties in the hands of recognized experts—men who have the broadest line, unlimited manufacturing facilities and a 116-year-old background of scientific research to offer you? See your Fairbanks-Morse dealer or call our local branch office now.



SILENT MEMBER—An added advantage is the line of electric motors designed and built by Fairbanks-Morse—for use on Fairbanks-Morse pumps. *They cut your pump selection job in half*—give you a pump manufacturer ready to take *all* the responsibility in selecting your pump and the power to operate it!

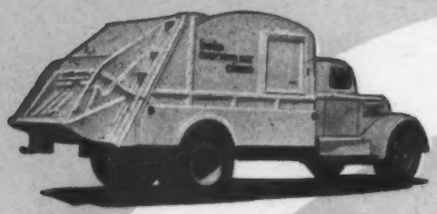
OUT OF THE HOLE—Fairbanks-Morse and Pamona deep-well turbine pumps have long been at home in bringing water out of the hole at rock-bottom cost—on farms, factories and wherever vertical turbines are used.

FAIRBANKS-MORSE

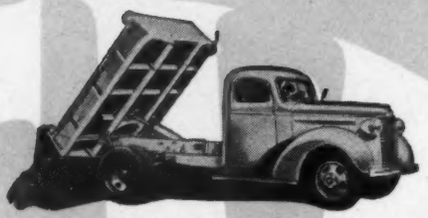
A name worth remembering

DIESEL LOCOMOTIVES · DIESEL ENGINES · MAGNETOS · GENERATORS · MOTORS · PUMPS
SCALES · STOKERS · RAILROAD MOTOR CARS and STANDPIPES · FARM EQUIPMENT

BETTER BUILT FOR BEST PERFORMANCE

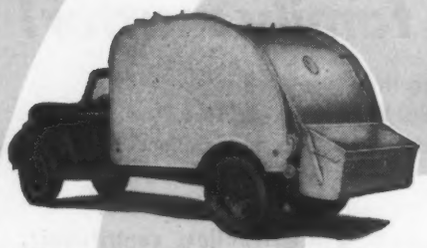


The Load Packer (patented) all enclosed garbage and refuse unit. Compresses loads hydraulically.



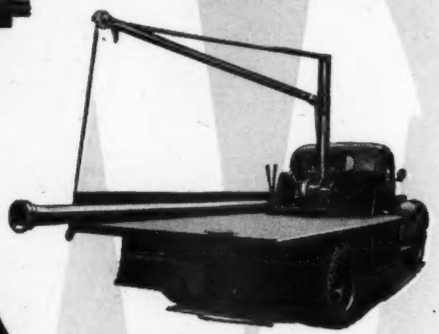
Type C12 Body and Model D6 or D7 Hoist. Dumping angle 55°.

Repair Tower, two sections, insulated platform.



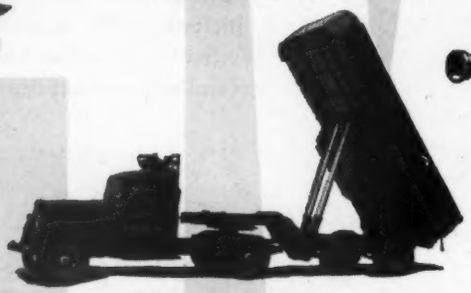
The new Bucket Loader, an all enclosed sanitary refuse disposal unit.

Telescopic boom Crane. Boom radius 8 to 20 feet.

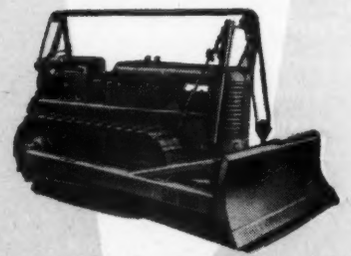


Crane Model 916 with Winch—also available with Dump Body.

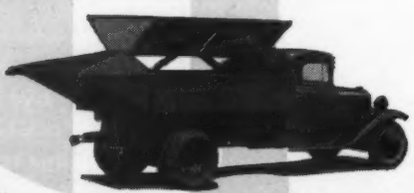
Crane Model 4812 for heavy parkway work.



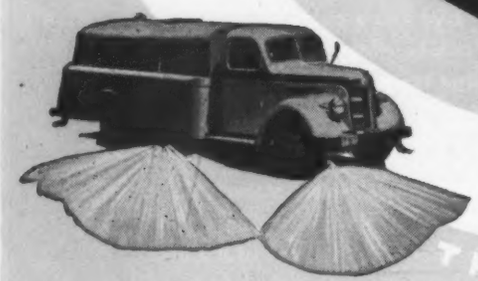
Special Garbage and Rubbish Body on semi-trailer.



Cable Dozecaster with angling blade.



Type C28 scow end Garbage Body. Steel hinged covers extra equipment.



Street Flushers and Sprinklers.

Type C50 Garbage Body with sliding steel covers on each side.

TRADE MARK

GW TRADE MARK

GAR WOOD INDUSTRIES, INC.

7924 RIOPELLE ST. • DETROIT 11, MICH.

WORLD'S LARGEST MANUFACTURERS OF TRUCK AND TRAILER EQUIPMENT

OTHER PRODUCTS: TANKS • HEATING EQUIPMENT • MOTOR BOATS

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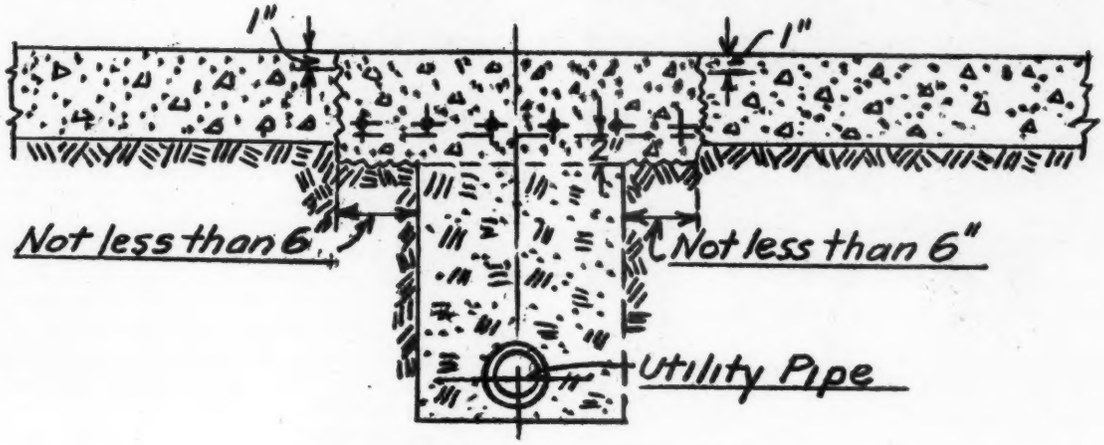


This illustrates the method of repairing a utility cut.

High Early Strength Concrete for Utility Openings and Other Repairs in Cement Concrete Pavements

Directions are given in detail for repair of openings in concrete surfaces where speed of repair is essential. Materials, preparation of subgrade and of the concrete, and mixing and placing the patch. Data adapted from information supplied by:

F. D. WOODRUFF

Assistant Superintendent of Maintenance, New Jersey State Highway Department

REPAIR of portland cement concrete pavements on heavily traveled highways requires a working control, not only of the methods to be employed, but of the various aggregates, water content, and admixtures, if used, as well. No specific laboratory supervision can be expected. Traffic conditions, time element, and sometimes unskilled workmen make it essential that a few simple rules be fixed in order that the very earliest high strength be obtained in the repair of these pavements. It is the rule that newly constructed concrete pavements must be cured approximately fourteen days before they are subjected to heavy traffic. It would be extremely disadvantageous to close any modern heavy traffic highway for such a period for the purpose of curing the restoration of a utility opening or repairs to miscellaneous failures.

The necessity of maintaining expensive and in many cases dangerous detours, and the disturbance to through traffic, may be almost completely eliminated by the development of high early strength methods. The curing time, when proper control is exerted, can be reduced to 18 or 24 hours, and even under adverse conditions to not in excess of 72 hours. Where patches are to be opened to traffic in eighteen hours, conditions must be almost ideal, workmanship must be of the best and accelerating admixtures must be employed generally.

Surprising results may be obtained by adhering to the following general fundamentals:

Cement.—Special cements requiring unusual curing methods and treatment are not readily adaptable to average working conditions. Finely ground and specially burned portland cements requiring no treatment other than that given ordinary cement may be used. When these cements are not available, the standard commercial brands of portland cements may be used.

Water.—The varying acid or alkaline conditions characterizing the average available water, which factors affect the ultimate strength of the resulting concrete, will not be determinable for usual cases in the field. Care should be exercised in order that water showing strikingly undesirable characteristics is not used. All other conditions being as nearly perfect as possible, the use of inferior water will as a rule produce poor results.

Sand.—Sand should be well graded in size, washed clean and completely free from all foreign material. Excessively fine material will usually require the use of additional water to produce a workable mix and in all probability will result in inferior concrete.

Quick repair is essential on heavily traveled routes.

Stone or Gravel.—Stone or gravel should contain no loam, vegetable matter or decomposed fragments. The size of the coarse aggregate to be employed will depend upon the character and extent of the repair section being treated. Small size coarse aggregates are better for small patches, while the standard larger graded aggregates are suitable for larger areas.

Proportions.—Since the determination of the void content of the coarse aggregate may not be made in emergency repairs, an arbitrary mixture should be decided upon for average conditions. This should range between 1:1½:2 and 1:1¾:3½. The richer mix should be used for patches of two square yards or less, and ¾-inch coarse aggregate is preferable for these. For patches exceeding three square yards, the larger aggregate and the 1:1¾:3½ mix should be used. It is obvious that the smaller the repair section the greater is the effect of impact load insofar as bond may be considered. Where a comparatively large repair area is involved, these impact bond stresses are not exerted so quickly as on the small bond perimeter because of the gradual rolling load, but with the lesser areas the load is immediately transferred to a relatively small area. It follows that the smaller repair section should receive more attention and in consequence richer and closer bonding mixtures should be used. Whatever mixture may be determined upon, it is essential to increase slightly the cement ratio in the composition of the repair section. This increase may be fixed at 10%, although during summer temperatures where admixtures are used, flash set should be closely guarded against. Where the original composition of the pavement being repaired is known, the same mixture may be used in large repair sections.

Preparation of the Subgrade

Utility Trenches.—Not less than 6 inches of the concrete pavement should be removed beyond the edge of the utility trench. The subgrade so exposed, if of the proper stability, should not, in any manner, be adjusted. No foreign materials should be added to the subgrade, except where it becomes necessary to remove unstable material for a depth in excess of six inches. Where doubt exists as to the quality of the underlying foundations, the normal surface of the subgrade adjacent to the trench should be reduced for a sufficient depth to secure a substantial support.

The backfill placed in the excavated trench, of course, must be thoroughly compacted, either by flooding or mechanical tamping. Wherever possible, this flooding or tamping treatment of the trench backfill should be carried out in layers not to exceed four inches.

Surface Failures.—Surface failures may result from the use of inferior materials, poor workmanship, improper subgrade compaction or bad drainage. The repair section should be of such quality as to correct the inferior workmanship and material factors, while a simple inspection should determine the necessity of auxiliary lateral drains to overcome any objectionable water levels. Where failures have occurred because of insufficiently compressed subgrade, it is essential to remove all material underlying the pavement which may give any indication of instability. Where the removal of the subgrade for a depth exceeding 6 inches becomes necessary, a thoroughly compacted sub-base of broken stone or other suitable material should be substituted. To overcome the possibility of such instability extending beyond the limits of the repair section, the subgrade under and adjacent to the section to be patched should be removed as far as possible. While this treatment may not be as effective as the removal of additional surface area, it has been found that radiating progressive failures have been almost completely overcome by this procedure.

Preparation of Repair Edges.—No edges, uniformly plumbed and tooled for the total depth of the pavement, should be permitted where either utility opening or surface failure repairs are to be made. The upper section of the adjacent concrete, however, should be plumbed for a depth not to exceed one inch to secure a firm shoulder. In some cases, old surfaces have been found where oil film has penetrated to a considerable depth. No permanent bond can be expected where this condition prevails, although a rough abutting edge undoubtedly offsets this factor to some extent insofar as bond is involved. Where a permanent bond is required, the use of a perfectly plumbed edge invites early failure of the union between the old and new pavement and the consequent "punching out" of the restoration. A rough, uneven adjacent edge, properly treated, adds materially to the strength of the repair section and insures more effective bonding. Spalled or scaled surface areas of old concrete immediately abutting upon the area to be restored should not be plastered with portions of the mixture placed in the restoration. Such shallow repairs quickly chip out, and thus leave a non-uniform surface and subject the restored area to undesirable impact loads. To obviate this condition it may be necessary to remove sufficient additional old concrete to provide an even surface at the intersection of the old and new concrete.

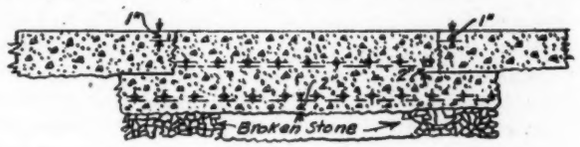
Reinforcement.—Reinforcing steel, preferably ⅜-inch deformed, should be placed in the restored section 2 inches above the bottom of the slab. The amount of such reinforcement to be used will depend upon the dimensions of the opening being repaired and upon the condition of the subgrade. In general the spacing of this reinforcement should conform to the spacing found in the old pavement both transversely and longitudinally. Where reinforced pavements are encountered, either in the repair of utility trenches or failures, the existing reinforcement in the area of the repair should not be removed, but should be bent out of range of repair operations until the section is to be

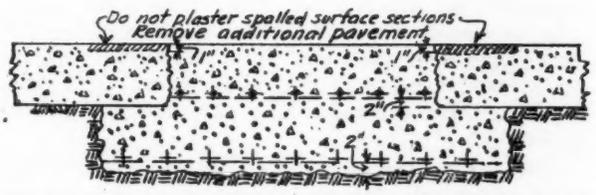
replaced, at which time the steel should be returned as nearly as possible to its original position and tied in with new reinforcement. Where unreinforced pavements are encountered, a mat of bars not more than twelve inches center to center should be employed. Such reinforcement is of vital importance in restorations over service trenches.

Method of Placing Concrete Mixture

Treatment of Repair Edges.—The edges of the existing pavement, which have been faced vertically for a depth not to exceed one inch measured from the surface, should be thoroughly washed, wire brushed, wetted down and painted with a 1:1 neat cement coating immediately previous to the placing of the concrete mixture. This treatment is quite essential at all times, but obviously more so with high summer temperatures, during which periods the edges must be completely cooled and saturated previous to applying the cement mortar coating, and this should be followed immediately by the placement of the concrete mixture.

Concrete Mixture—Plain.—The water content of any plain mixture should not exceed 4 gallons per bag of cement, less the moisture content of both fine and coarse aggregates. During certain periods of the working day, a stock pile being used from the bottom may contain much more water than may be found in the top of the same pile. This condition, which is beyond any systematic control, must be carefully watched and the water added at the mixer drum adjusted accordingly. The aggregates, without admixture, should be mixed from 2½ minutes to 5 minutes in a machine mixer. No hand mixing methods should be employed. The resultant mixture should flow from a square





Above, repair when subgrade under sound surface is poor. Below, the damaged surface section cannot be repaired.

pointed shovel with difficulty and should show no appreciable slump when dumped upon the subgrade. Any mixture showing more than a one-inch slump in 12 inches should not be used in high early strength repair work. The 4-gallon water-cement ratio mixture will as a rule produce a consistency which is called "unworkable." This "unworkable" mixture should be placed in the repair area in 2-inch layers, each layer being thoroughly compacted by either manual or mechanical manipulation. No initial set should be permitted before the repair in layers is completed. This factor is of vital importance and the time of initial set should always be carefully checked. The final "dry" layer of concrete having been placed, it must be tamped sufficiently to bring out a workable surface; the surface should be roughly planed and kept slightly above the finished grade. Initial set will, in average temperatures, occur in from ten to twenty minutes after the final agitation of the mixture, and

Sometimes a truck mixer will speed up repair work.

may be recognized by the sudden recession of the light water film found upon the surface of a well-tamped concrete mixture. At the point of initial set the surface should again be tamped thoroughly, planed to grade and finished to the proper surface. No proper bond can be expected unless the concrete mixture is reworked at the point of initial set, at which time the total ultimate shrinkage is about to take place. Neither can a suitable bond be expected unless the edges of the adjacent concrete are first cleaned, then washed and given mortar treatment.

Concrete Mixture—With an Admixture.—Calcium chloride may be used to advantage when necessary to secure high early strength rapidly under emergency conditions. Freezing weather and the construction of driveways to hospitals and fire houses and the repair of sections under super-traffic conditions make necessary the reduction of the freezing point and the rapidly increased acceleration of the final set. The fact that the use of calcium chloride only slightly reduces the freezing point must be considered. In low temperatures it is quite essential to heat not only the water, but the other aggregates as well. Neither should any concrete be placed upon a frozen subgrade.

A portland cement concrete mixture containing calcium chloride should contain no more water than that used in plain mixtures, but such mixtures must be manipulated much more quickly than the plain cement combinations. Initial set takes place much earlier, especially with high temperatures, and in consequence the depth of the layers to be tamped should be increased to not less than four inches. The same procedure of finishing as used for plain concrete mixtures should be followed just prior to the initial set, although at low temperatures there appears to be no difference between the action of a calcium chloride treated mixture and an untreated mixture in summer weather. The water and fine and coarse aggregates should be heated during freezing temperatures. This will insure more rapid hardening of the concrete. Where this procedure is followed, temperature conditions must be given utmost consideration and the pro-

(Continued on page 38)

Practices of City Water Departments in Regard to Cross Connections

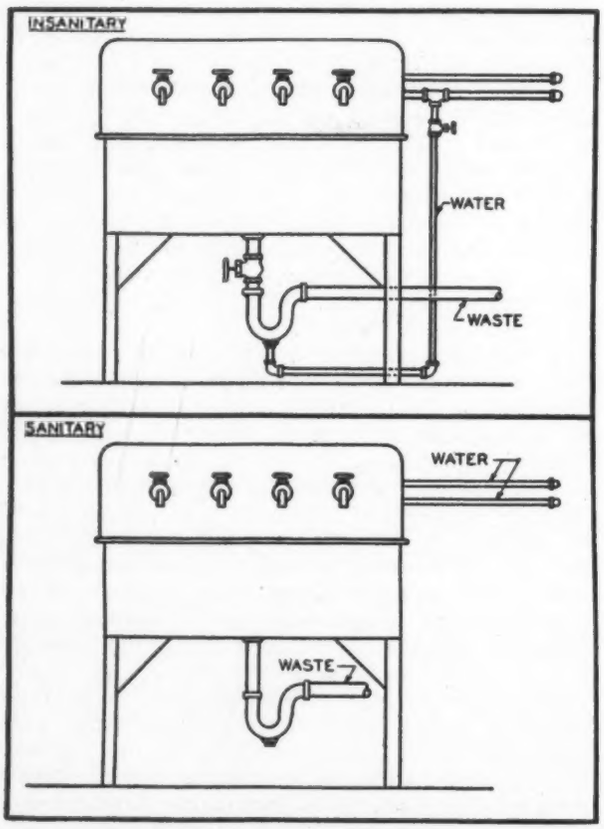
This is a continuation of the data reported in the March issue. Information regarding practices in other cities will appear in an early issue.

Kentucky—Seven replies: four inspect regularly; six require disconnection; one permits a single check valve. In Ashland, "No physical connection is allowed with an unapproved supply." Cynthiana reports that "We repair them when found." Frankfort states they have "Open space in piping with a swinging connection." Middlesboro reports "We do not have any." Owensboro reports that they use "Check valves."

Louisiana—Three replies: two inspect regularly; three require disconnection; one requires a double check valve. Alexandria reports "Valved off with 18" nipple cut and left out of service line."

Maryland—Five replies: four inspect regularly (Hyattsville states that factories, industrial plants, etc. are few and small in number in this area. "We recently made a check of establishments having air-conditioning installations."); three require disconnection. Hyattsville also reports that they "Require absolute disconnection." Salisbury states that "None is permitted."

Michigan.—Forty-one replies; twenty-four cities inspect regularly for cross-connections. Albion reports that "they are inspected by the County Health Department; also, that they are now studying the situation in regard to the use of double check and single check valves and of devices for use on 4-inch and smaller lines having connections to unsafe or potentially dangerous sources." The cross-connections in Dearborn are inspected by the Michigan State Health Department; this city requires disconnections and double check valves. Twenty-two other cities require disconnection; eleven require double check valves and three permit back-flow preventers. Battle Creek is "considering the use of swing check valves." Cheboygan "requires disconnection unless they have pure water," and Lansing "doesn't disconnect if connected to a potable supply." Niles "requires disconnection if the source is not approved, otherwise use double checks." In Charlotte "no devices are permitted on 4" and smaller lines having connections to unsafe or potentially dangerous sources." Coldwater "permits no such connections under any conditions." Dowagiac "disconnects." In East Grand Rapids "none is permitted." Escanaba reports "open pipe." In Flint, Iron Mountain, Jackson, Ludington and Ypsilanti "cross connections are not allowed." Grand Rapids says "all connections to foreign supply are illegal." Grayling "eliminates such connections." Harbor Beach uses "double sealed valves." Lansing states "no physical connection." Mt. Pleasant "disconnects." Muskegon reports the use of "air gaps or a removable piece such as a swing joint." "We have no such sources," says Plymouth. St. Johns uses "gate valves"; St. Louis, "flow into open tank." South Haven "does not permit cross connections; they must have removable pipe, as it is a State Board of Health requirement." In Wayne, service is "discontinued until a safe source is disconnected."



Water cross-connection to kitchen sink.

Minnesota.—Twenty-four replies; seventeen cities inspect regularly for cross-connections; eighteen require disconnection; two cities permit double check valves and three permit back-flow preventers. Alexandria and Stillwater each report that "no cross-connections are allowed"; and "no cross-connections are in use" by Chisholm, Owatonna, South St. Paul and Springfield. Caledonia says "just ordinary gate valves." Cloquet "disconnects all lines from unsafe supply." "Check valves are in use" by Crookston. Little Falls "does not have any cross-connections." Minneapolis reports that there must be a "complete physical disconnection." Moorhead, "if in doubt, we disconnect." Red Wing uses "valves only." St. Louis Park "has no pipe smaller than 6". Virginia says "discharge to an open tank with a pump to point of use."

Mississippi.—Seven replies; two cities inspect regularly for cross-connections. (Grenada reports that the inspections are made by the Health Department in their city). Two cities require disconnection; two permit double check valves, and one a back-flow preventer. Cleveland uses "check valves." In Jackson,

"two check valves with a vacuum breaker between" are in use. Tupelo requires "a mechanical disconnection, or double checks and a vent." Vicksburg says it uses "check valves."

Missouri.—Seventeen replies; seventeen inspect regularly for cross-connections; twelve cities require disconnection. One city requires a double check valve and two require back-flow preventers. Bonne Terre uses "double checks." Butler "requires all connections to tanks to discharge above water line." Lebanon does "not make direct connection to unsafe sources." Liberty reports "no cross-connections." Monroe City says "We have no dangerous connections." Perryville reports "We have a case of this kind. One gate valve is in between our water and a well suply. We keep close watch on the well supply." The city of Rolla reported, in answer to our question regarding connections on 4-inch and smaller lines: "We use gate valves so long as our pressure is above theirs; if their pressure is equal or greater than ours, we lock the valves." In St. Louis, "no cross-connections are allowed." Slater states that "a section of pipe is completely removed."

Montana.—Six replies; three cities inspect regularly; five require disconnection; two cities permit double check valves and one a single check valve. Bozeman "tries to prevent having cross-connections; we have only three to our knowledge." Dillon "has no small lines." Forsyth "requires double check valves if disconnection is not feasible." Roundup has "no cross connections."

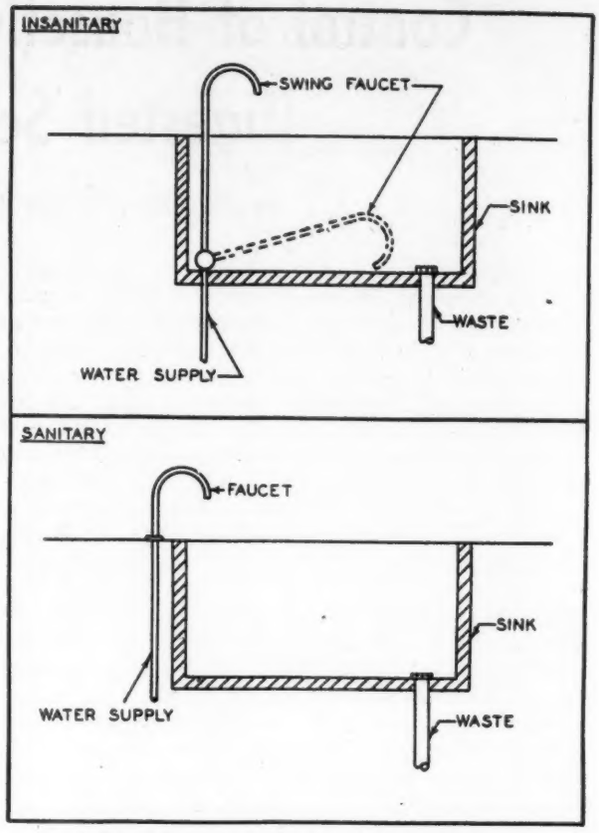
Nebraska.—Sixteen replies; six cities inspect regularly; four require disconnection; one city requires single check valves. Fairbury has no lines smaller than 4". In Hastings and Kearney, there are "no such connections." Norfolk states "few cross connections and they are open, and we will force disconnection when material and labor are available." York also reports "no cross-connections."

New Hampshire.—Three replies; one city inspects regularly for cross-connections; two require disconnection; one city requires double check valves and one a special back-flow preventer. Berlin "disconnects or uses double check valves"; and Portsmouth uses "check valves."

New Jersey.—Twenty-four replies; 16 cities inspect "regularly" and one city "occasionally" for cross-connections; twelve require disconnection. Thirteen permit double check valves, one city permits a single check valve and one a special back-flow preventer. Atlantic City uses "double gate and double check valves." In Elizabeth, "double check valves are not allowed." Fair Lawn reports "do not have any 4" lines," and the same condition exists in Haddonfield. Kearney "has no such connections; if same existed, would use double check valves." Montclair uses "the standard, rubber-faced double check valve hook-up as prescribed by the Factory Mutual Insurance Co." In Rockaway, "double check valves are installed on all cross-connections, and a manual valve on either side of the two checks as required by state law."

New Mexico.—Three replies; one city reports that it inspects regularly for cross-connections and one occasionally; two require disconnection; one requires double check valves. Carlsbad has no cross-connections on its system; also Deming. Santa Fe "eliminates connections."

New York.—Fifty-one replies; thirty-nine inspect regularly for cross-connections and one "occasionally"; thirty-four require disconnection (in Garden City, disconnection is required in some instances, and on remaining connections regular submission of bacteriological analyses). Mechanicville reports that it disconnects or requires double check valves. Nineteen cities permit double check valves, one a single check valve and three back-flow preventers. Seneca Falls does not allow double check valves; Walton permits their use under certain conditions. The cities of LeRoy, Little Falls, Penn Yan, Port Jervis and Watkins Glen each report that "no cross-connections are allowed." In Binghamton, inspection of cross connections is done by the Health Department. Corning states that "the only connections are at the Corning Glass Works; their supply is potable and double checks are used at all cross-connections." East Aurora reports "Swing joint—only one source can be used at one time." "Cross-connection installations must conform to the New York State Health Law" in Elmira. Freeport requires "a positive swing joint connection." Fulton permits "no connections to non-potable water." Glens Falls reports, "complete separation." Mamaroneck, Harrison, Norwich, Peekskill, Seneca Falls and Waverly each "disconnect." Hornell "allows no unsafe connections to unsafe sources." In Hudson, "under N. Y. State regulations the lines must be physically disconnected." Middletown reports "air gaps." The New York State Health Department makes inspections in Ogdensburg. "Double check valves" are in use by Oneonta. Salamanca states that "swing connections with double check valves" is the method in use. Saugerties reports "have no cross-connections to unsafe water; if we were obliged to use another source of supply, it would be chlorinated." Schenectady uses "swing joint connections." In Syracuse "open swinging link valves are in use." Waterford "uses bronze swing check valves on all industrial service lines, which are metered; detector check-valves on fire services."



Right and wrong laboratory sink installation.

Control of Housefly Breeding in Partly Digested Sewage Sludge

By THEODORE A. OLSON and REYNOLD G. DAHMS

Both Lt. Col. Olson and Lt. Dahms are entomologists and officers of the Sanitary Corps. Col. Olson, recently separated from the Army, has returned to his post as Assistant Professor in the School of Public Health, University of Minnesota. Lt. Dahms was with the U.S. Department of Agriculture before the war. At the time this investigation was made, both were assigned to the Eighth Service Command Laboratory, Fort Sam Houston, Texas. This material was published originally in the Journal of Economic Entomology and is reproduced here with the approval of Dr. L. M. Peairs, its editor.

SEWAGE plants operating under optimum conditions experience no difficulty with respect to the breeding of the housefly, *Musca domestica*, in the sewage sludge. However, under certain unfavorable operating conditions it becomes necessary to withdraw sludge before it has been completely digested. This type of sludge which is often referred to as "green sludge" will not dewater readily and offers an ideal environment for housefly breeding. When a problem of this kind occurred in one of the Eighth Service Command installations, a rotenone water-emulsifying solution was recommended as a larvicide. A sample of the material was sent to the Eighth Service Command Laboratory for the purpose of testing its efficiency.

Sludge used in this experiment consisted of equal parts of freshly drawn, completely digested sludge and "green sludge." Inasmuch as this material was too high in moisture content, it was dewatered by suspending it in a cloth bag overnight. The sludge was then divided into 24 equal portions of approximately 250 ml. each and put in glass jars. Maggots used in these tests were reared in an artificial medium consisting of 1 part ground whole oats, 2 parts ground alfalfa and 5 parts of wheat bran moistened with a solution made up of 1 teaspoonful each of dried yeast and *Maltine* in 1 liter of water. *Maltine* is a concentrated extract of malted barley and of wheat and oats. One hundred healthy, third instar larvae produced in this medium were placed in each jar of sludge. The larvae were then allowed a 5-hour period to adjust themselves to the new environment before the larvicides were applied.

The 24 jars were divided into six groups of four each; five groups were treated with the larvicides; those remaining constituted the control. Inasmuch as under actual field conditions a crust is usually formed over this type of sludge, it was believed that mere surface application might not be effective and that a thorough mixing of the larvicide with the sludge might be needed. Therefore, the larvicides were thoroughly stirred into the sludge of half of the jars while it was simply applied to the surface in the remainder. The controls were treated similarly except that no larvicide was added.

Because they were readily available to Army installations, the following larvicides were selected for comparison with the submitted rotenone sample: borax, DDT emulsion, DDT dust and kerosene. Borax was applied as a 30% solution (by weight). The DDT emulsion was prepared by adding 5 parts of 5% DDT in kerosene to 10 parts of *Triton 770* and 85 parts of water. The DDT dust was the standard larvicide powder which is composed of 10% DDT and 90% talc. The final rotenone emulsion was made by adding 5 parts of the 1% concentrate to 95 parts of water in accordance with the manufacturer's recommendation.

In all of the tests, liquid solutions (borax, DDT emulsion, rotenone and kerosene) were applied at the rate of 0.15 gallon per cubic foot, or 2.93 gallons per 100 square feet of surface. The DDT dust was applied at the rate of 0.75 pound per cubic foot, or 14.77 pounds per 100 square feet. In all cases percentages are based on the use of 100 larvae per test.

The results obtained with these tests and given in

(Continued on page 39)

Emergence of Housefly Larvae from "Green" Sewage Sludge Treated with Various Larvicides

Treatment	Per Cent Emergence	Per Cent Pupated But Not Emerged
Control		
Stirred	64	9
Stirred	88	8
Not stirred	60	22
Not stirred	87	6
Average for Controls	74.75	11.25
30% Borax Solution		
Stirred	0	0
Stirred	0	0
Not stirred	0	0
Not stirred	0	0
Average for Borax	0	0
10% DDT dust		
Stirred	5[1]	23
Stirred	2[1]	26
Not stirred	1[1]	20
Not stirred	2[1]	49
Average for DDT Dust	2.5[1]	29.5
0.25% DDT emulsion		
Stirred	66	5
Stirred	71	0
Not stirred	71	16
Not stirred	82	9
Average for DDT emulsion	72.5	7.5
0.05% rotenone emulsion		
Stirred	76	6
Stirred	74	6
Not stirred	85	2
Not stirred	75	9
Average for rotenone emulsion	77.5	5.75
Kerosene		
Stirred	0	0
Stirred	0	0
Not stirred	0	0
Not stirred	0	0
Average for Kerosene	0	0

[1]Flies which emerged died within two hours.

New Lighting to Aid Airport Operation

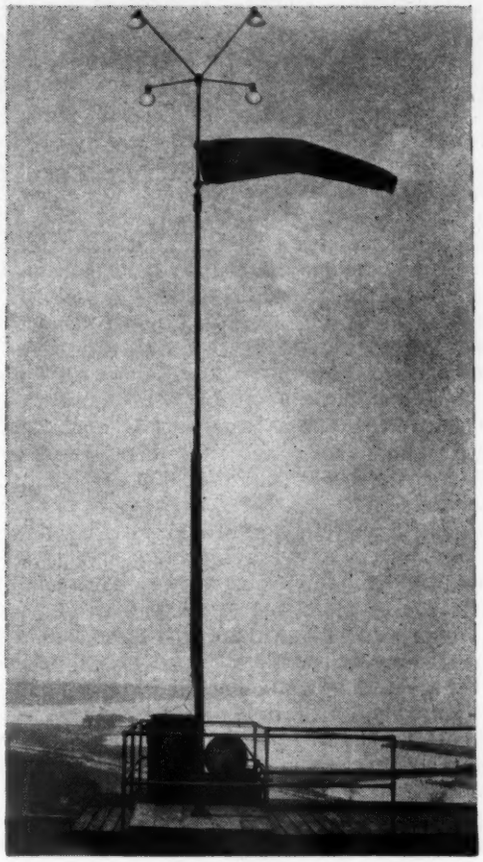
By W. A. PENNOW

Lighting Engineer, Lighting Division, Westinghouse Electric Corporation.

WHILE many of the developments that have taken place in aviation lighting in the last four years are obviously military and probably will not be used in future commercial airline operations or in private flying, others have a very important part in future civil installations. In addition, the standardization program carried out by the Air Force engineering groups has materially improved and speeded up the evolution of pre-war airport lighting equipment.

For example on runway marker contact lights, a standardization program took place on a unit basis. These lights were divided into base and top sections, and any top section will fit any base. These contact lights were originally designed for dead loads—such as a plane taxiing over it—of 80 lbs. per square inch, or about 7500 pounds load. Early in 1943 mass production was under way on units that withstood 100,000 lbs. dead load. Late in 1943 this moved up to 150,000 lbs., early in 1944 to 175,000 lbs., mid-1944 to 200,000 lbs., late 1944 to 225,000 lbs., and tests have been completed on units that successfully withstand dead loads of 275,000 lbs. The end is not in sight. The lights are ahead of the planes now in use, or projected, but as planes get heavier and taxi speeds go up, the lights will have to get stronger.

How the approach angle indicator works.



Illuminated wind cone for small and medium airports.

One of the new types of equipment that should prove valuable for many small private and feeder line airports is the mobile floodlighting unit. It is a jack-of-all-trades, costs about half as much as a very low cost floodlighting installation and gives as much light as an installation of 10 times its cost. It is completely self contained, carries its own generator, transformer and switchboard, can be used as a super-power searchlight for low visibility operations, a landing area floodlight to light any size runway for any weather condition that permits flying, a landing area floodlight of sufficient power to light the entire area of small, all-way (no runways) airports, a mobile floodlight unit for lighting crash areas, etc., or as an emergency power unit. The generator is 12 Kva at 115/230 volts, 60 cycles, for maximum utility. A power take-off arrangement permits use of the assembly either parked or in motion. The truck engine drives the generator.

Another of these special purpose units that should come into wide use is called the "Approach Angle Indicator." By the use of precision type lenses, much like those in a motion picture projector, and a 100-watt lamp a tricolor beam—yellow, green and red is projected from the approach end of the runway toward the incoming plane. The color bands are so arranged that when the pilot sees the light as green, the plane is in the proper vertical approach zone. If it appears yellow the plane is too high; if red, too low. As the green beam is only 2 degrees wide vertically, and green-red is less than 5 minutes of arc vertically, a plane staying in the green area can make a power landing with safety. Small airports that are usually unattended at night will need only a lighted wind direction indicator for the airport and one of these units at each end of each landing strip to provide

reasonable landing facilities for private night flying.

A vastly different set of problems must be considered for each type of airport. The range may well be from an airport such as Lost Nation at Willoughby near Cleveland, with 10 to 100 private plane movements per day to the proposed super airport for the city of New York, where the airport design is based on six aircraft movements per minute (one every ten seconds) or about 9000 movements per day. During the last Air Races at the Cleveland Municipal Airport, 1316 takeoffs or landings were recorded in one hour, over 25 per minute, nearly one every two seconds. This airport is an all-way field, and operations are not limited to one runway. Several military fields have logged upwards of 20,000 aircraft movements per day. It is true that these figures will not apply to many postwar airports, but they do show what the designer must consider. The figures now being used cover a range from 10 movements to 10,000 movements every 24 hours.

The small, privately owned airport, whether operated individually, by a flying club, or a small community, will probably be an all-way field, one having no runways or stabilized surface. Lighting for this class of airport will consist of a beacon, either rotating or flashing, a boundary circuit to outline the safe landing area, and an illuminated wind direction indicator, probably a wind cone or "sock". These are basic requirements. If activity and finances permit, a mobile lighting unit may be used as an all-purpose floodlighting system.

Next will be the small Municipal Airport, built and operated with civic funds. Communities up to about 20,000 population will need airports of this type. Generally these will have two or three runways of stabilized soil. Lighting for this class of airport must be sufficient for private and feeder aircraft. It will include a beacon, rotating or flashing; runway marker lights to outline the runways; approach angle indicators at each end of each runway; and an illuminated wind direction indicator, either a wind cone or a wind tee. If activity and funds permit, a mobile lighting unit should also be used.

Large communities, up to 100,000 population, will have good sized airports with at least 4 paved runways and these must be equipped to handle aircraft movements at an average of one every 5 minutes. These movements will include private planes, feeder planes and, in many cases, commercial units. Speeds of these on approach and takeoff will vary from zero for helicopters to about 120 miles per hour for commercial airliners. Lighting facilities must be capable of accommodating any one group or any combination of these planes in order to insure maximum safety. Basic lighting will consist of a rotating beacon; flush type runway marker lights and flush type range lights, both the latter equipped with brightness control and runway selector control so brightness can be varied to suit atmospheric conditions and only the runway to be used will be lighted; illuminated wind indicators of the smoke generator type located near the approach end of each runway to give the pilot an exact picture of wind direction and gustiness; landing area floodlights at each end of each runway; approach angle indicators at each end of each runway; and a low visibility approach lighting system at the end of at least one runway. This will be tied in with the radio approach system.

There will be a considerable growth in airports and airways. We must try to forecast the problems that will arise and have the answers to them at hand. In postwar aviation, we will have four broad classes to consider. In numbers of planes, these will be 1—Military, 2—Private, 3—Feeder and 4—Commercial. In daily aircraft movements, the order will be 1—Private, 2—Feeder, 3—Military, 4—Commercial. In daily mileage, the order appears to be 1—Commercial, 2—Feeder, 3—Private and 4—Military. In traffic congestion at airports the order will probably be 1—Commercial, 2—Private, 3—Feeder, and 4—Military. With this analysis plotted on curves and charts, a definite guide for probable requirements can be established.

Costs of Laying Water Pipe

Costs of laying water pipe, including labor, cartage, transportation and materials, but not including overhead are reported by the Hartford, Conn., Water Bureau for the years 1935 to 1944, inclusive. No 4-inch pipe was laid after 1942, but costs for this size in that and preceding years were as follows: 1942, $1.282; 1941, $1.875; 1938, $2.638 (this was largely hand work); 1937, $1.148; 1936, $1.935; 1935, $1.032.

6-inch.—The costs on 484 feet of 6-inch pipe laid in 1944 totalled $4.030 per ft., of which $2.471 was for labor, etc., and $1.559 for materials. On 323.6 ft. where the work was done by hand, the costs aggregated $4.529 per foot, but on 160.5 ft. where machine trenching was used, the cost was $3.024 per ft. For the nine preceding years, beginning with 1943, per ft. costs were $1.576, $1.471, $1.839, $1.649, $1.834, $1.725, $1.649, $1.77 and $1.69.

8-inch.—The cost on 10,909.1 ft. of 8-inch pipe averaged $2.820 per ft. On the 49.4 ft. where hand trenching was necessary, the cost amounted to $4.924 per ft.; but on the 9820 ft. where machine trenching was possible, the cost was $2.838 per ft.; trenching was furnished on an additional 1039.7 ft., on which the cost was $2.443 per ft. In 1943, 8-inch pipe cost $3.879 per foot, and in the eight preceding years varied from $1.941 in 1941 to $2.518 in 1939.

12-inch.—The Bureau laid 2,474.2 ft. of 12-inch pipe during 1944 at an average cost of $5.403 per ft. This was all machine trenching; material costs were $2.976 and labor costs $2.427 per ft. The cost in the nine years previous to 1943 (in which year no 12-inch was laid) varied from $3.238 per ft. in 1936 (a WPA job) to $4.299 per ft. in 1938.

16-inch.—Only 257.4 ft. of 16-inch pipe was laid, practically all of which was machine work. This cost $8.317 per ft. for labor and $5.546 for materials, a total of $13.863 per ft. This is considerably higher than most previous years, though a hand-work job in 1943 cost $26.487 per ft. In 1942, the cost was $7.722 and in 1941, $4.857.

Elmira, N. Y., Water Board has reported on 1945 pipe laying costs. For 2201 ft. of 12-inch pipe, the average cost was $5.05 per ft.; for 1264 ft. of 10-inch, it was $4.00 per ft.; for 289 ft. of 8-inch it was $3.54 per ft.; and on 922 ft. of 6-inch it was $2.26 per ft.

These figures, even though the general agreement is fair, emphasize the part that local conditions have in influencing costs. Full consideration must be given to rock, hard dirt, ground water, constricted working area and many other factors.

In order to help others in estimating costs, it is requested that all water works superintendents and city engineers having reliable cost data on pipe laying in 1944 or 1945, send the information to the Editor of this magazine for early publication.

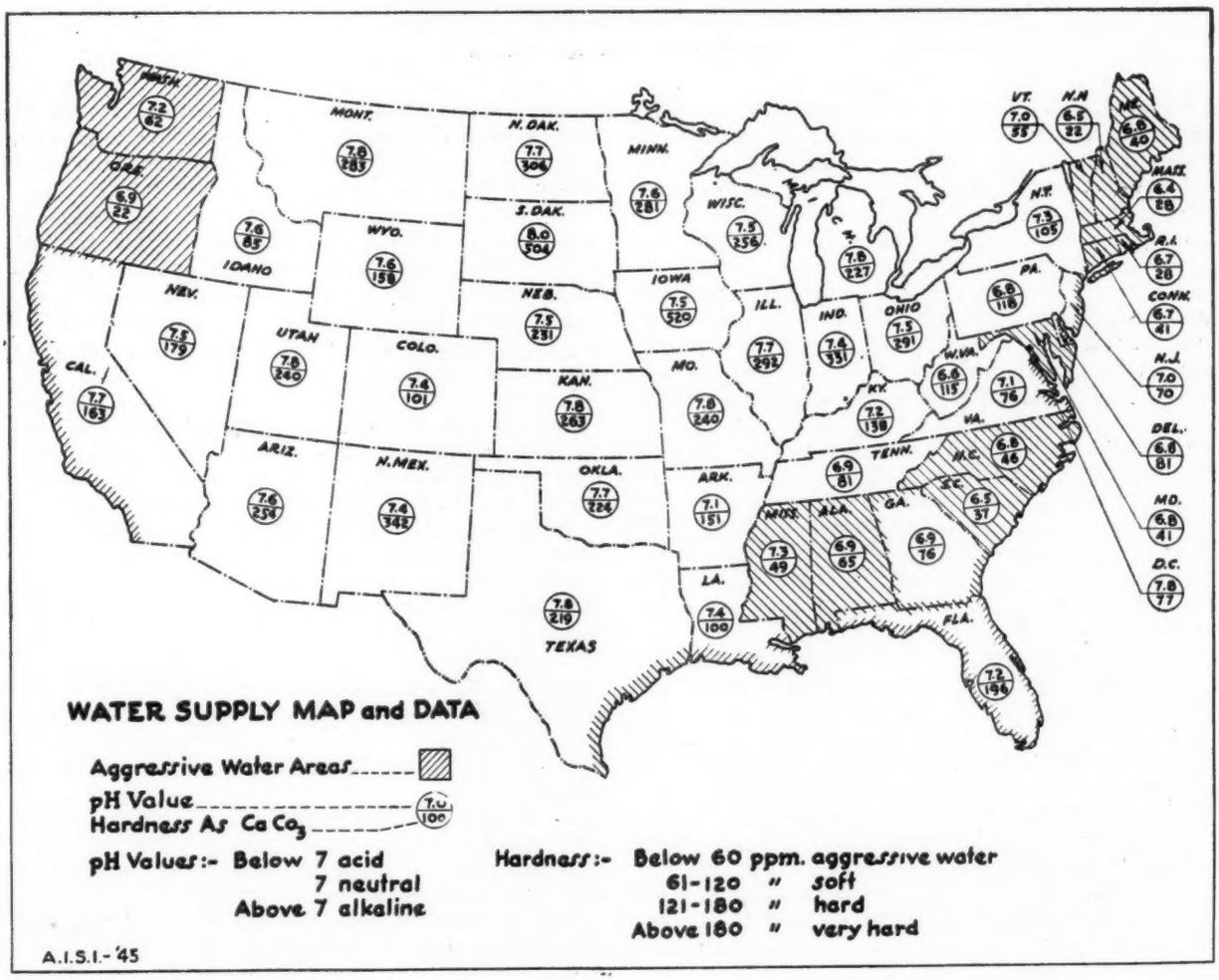
Classification of Municipal Water Supplies in the United States

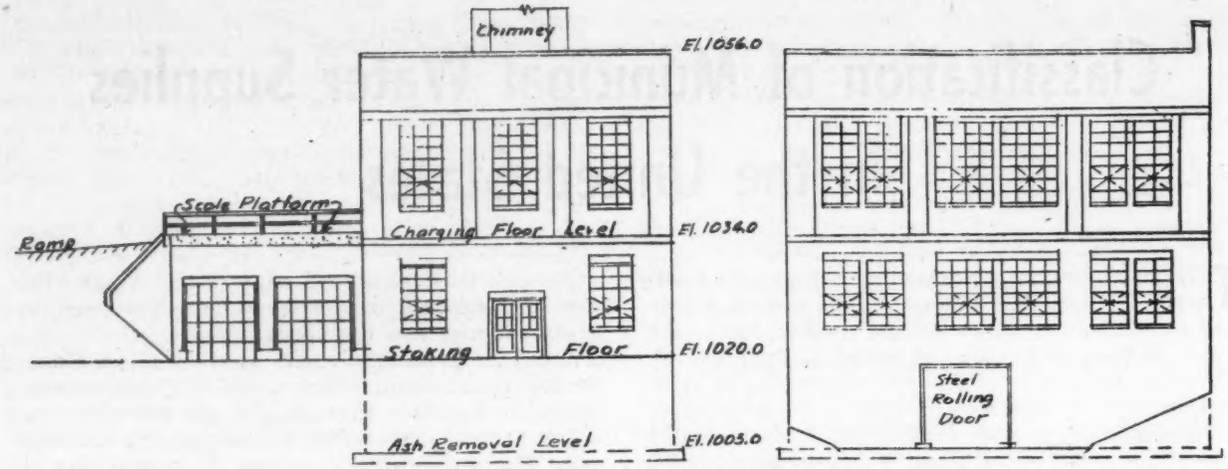
THE map herewith, which was prepared by the Committee on Steel Pipe Research of the American Iron and Steel Institute, shows a broad classification of the water supplies of the United States as "aggressive" and "non-aggressive." The cross-hatched states, comprising 10% of the area and 20% of the population, have mostly aggressive waters; while the unshaded states have mainly non-aggressive scale-forming waters. The map shows that, in general, the consumer in the greater part of the United States is more concerned with scale problems than with corrosion problems.

The map was compiled from data taken from 8,431 raw water sources throughout the United States. The water analyses are averaged by states and are divided into aggressive and non-aggressive classifications on the basis of hardness in terms of calcium carbonate and the pH value. The numbers in the circles on the map show for each state the average pH values above the line and the average hardness below the line. A water with a hardness below 60 ppm. is classified as a soft, aggressive water, while that above 120 ppm. is classified as a hard non-aggressive water. A pH value below 7.0 indicates an acid water and is generally associated with aggressive waters. A pH value above 7.0 indicates an alkaline water and is generally associated with non-aggressive waters.

Inasmuch as average results are shown on the map, the data must be used only as a general guide, as many other factors beside hardness and pH may affect the aggressiveness of the water. For instance, the darkened areas along the seacoasts indicate the overlapping effects of local conditions.

The report from which this map and the accompanying data were taken contains also a tabulation of water supplies arranged by states and cities, showing the source or sources of supply, the methods of treatment and the chemicals used by each city. Results of treatment to modify hardness and pH are also shown. Whereas, the 8,431 supplies shown on the map have an average hardness of 161 ppm. and (for 3,821 supplies) an average pH of 7.3, analyses of treated or tap water from 1,979 cities show a hardness of 103 ppm. and (for 1,868 supplies) a pH of 7.8. Data for the report were obtained from questionnaires, reports of State Sanitary Engineers, the U. S. G. S., Olson's study and the U. S. P. H. S.





Sections through the incinerator, showing elevations.

A City Engineer Reports on Garbage and Refuse Collection and Disposal

This report to the Council, covering probable cost of construction and operation and the necessary procedures required for setting up collection and disposal facilities, presents design factors of value to other cities. Bids on the project were received early this spring.

By T. H. SAUTER
City Engineer, Cuyahoga Falls, O.

PRELIMINARY data on the possibilities of constructing an incinerator, results of observation of various plants in use, the type of incinerator to be used, the methods of collection, and the cost of providing and operating a satisfactory collection and disposal system, were contained in a report made to the city council early in 1945.

A survey of incinerator sizes in 29 cities of comparable population, installed between 1924 and 1941, indicated that for a city of 27,257 population, average incinerator capacity was 79.7 tons capacity in 24 hours. This agreed very closely with the recommended capacity of 25 tons in 8 hours or 75 tons in 24 hours for Cuyahoga Falls, which was based on the following: The incinerator should have sufficient capacity to incinerate in 6 working days of 8 hours each, the combined 7-day accumulation of all the garbage and combustible refuse produced by the homes, restaurants and stores during the early fall months, when collections are at a maximum, at the rate of 1 ton per 1000 population to be served.

As a result of observation of various plants in operation, I believe that there is no comparable substitute for a modern built-in air preheater of the rapid heat transfer type, of the cast iron or carborundum tubular design, in a high temperature incinerator plant. The supplying of air for combustion preheated by the waste gases to approximately 400° F. is equivalent to the use of 46 pounds of coal per ton of garbage and refuse as dumped into the burning chambers. After looking at the various types of plants in operation, I do not know of any method of aid to combustion that is more satisfactory.

The building and grounds in connection with an improvement of this type can be just what the City desires in regard to physical appearance and odor resulting from the collection and disposal of refuse. Some cities treat this operation as a necessary evil, locate the plant in an undesirable area and make no attempt to operate on an efficient basis. Other cities, like Lakewood, Ohio, have plants that are well situated, operated at a maximum of efficiency and the physical appearance of which is a credit to any community.

The method of collection is of two kinds, privately controlled and municipally controlled. The fact that we have private collection in Cuyahoga Falls should have a very definite bearing on the successful operation of a plant for incineration of refuse.

In the city of Lakewood, Ohio, the collection is controlled by the City and regular route schedules are rigidly enforced. There is no overlapping of routes, the same collectors being responsible for all the collections at all times in their districts. In this way there is no duplication of effort. Since the city controls the collection of refuse, the schedule of delivery to the incinerator can be controlled to such an extent that the pickup trucks arrive at the plant on time with a variation of five minutes only allowed in the time of arrival.

In the city of Williamsport, Pa., where the refuse is collected privately, the efficient operation of a well designed plant is impossible because the refuse does not arrive at the plant on schedule.

One of the most notable things observed was that the garbage must be wrapped in combustible material

before being collected. This aids in rapid drying of the garbage and in combustion. The compulsory wrapping of garbage should be included in any legislation that is prepared when the city proceeds with this construction.

The type of incinerator to be used should not depend on the cost of construction, but should be selected as a result of observing successful operation over a period of years of incinerators of comparable design requirements.

The building itself should be so constructed that ashes can be deposited directly into a truck from a hopper under the dumping grates. This means that there must be three floor elevations, the charging, the burning, and the ash removal. Some cities that are not so favorably situated as Cuyahoga Falls must construct an elevated ramp to the building in order that the delivery trucks may reach the charging floor. We were able to select a site that eliminates the need for the elevated concrete ramp by using the natural ground as a means of reaching the charging floor.

The number of burning units should be so arranged in the incinerator that one half of them can be used as standby units in the event a shut-down is necessary to effect repairs.

Consideration could be given to the possibility of combining our proposed garbage incineration plant with the sewage disposal plant. In cities where these operations have been combined, large savings in disposal costs have been effected in disposal of both garbage and sewage sludge.

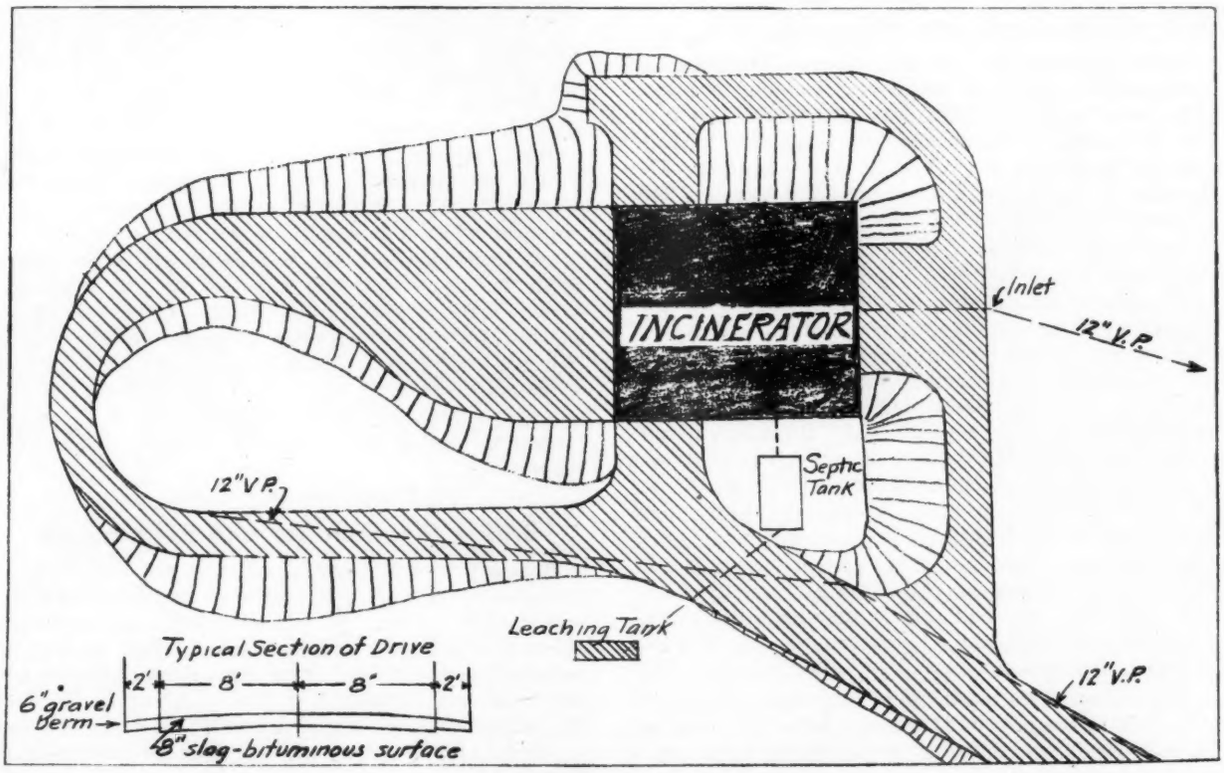
The similarity between the disposal problem of sludge and that of ordinary municipal refuse is generally recognized now more than ever before, with the consequence that, in the design of new sewage disposal plants, a large number of them combine the sewage plant head house and the incinerator building. The sludge may be fired into the incinerator furnace directly from the filters or it may be further dewatered by means of dryers, according to the amount of combustible refuse that is available as fuel. Heat for operating the dryers may be secured from the spent flue gases from the incinerator. By charging the sludge directly into the furnace along with the garbage and refuse an increase of only 25% in the daily capacity of the incinerator plant is needed to dispose of the sludge from the disposal plant. This type of dual incineration is possible in cities with populations up to 75,000. However, the distance our disposal plant is from the city would make this combining of operations questionable and would need further investigation before any definite statement could be made.

At the present time the city is paying $400.00 per month for operating under the deep fill method of garbage disposal or at a rate of $2.00 per ton on a basis of 200 tons per month. By agreement with the City of Akron, we might dispose of Cuyahoga Falls' garbage and refuse in the Akron incinerator at a rate of $4.25 per ton delivered to and dumped in the furnaces of the Akron plant.

The City of Cuyahoga Falls could install a garbage and refuse incinerator on property that it now owns for approximately $93,000 complete including the building, furnaces, scales, and landscaping of grounds. As a basis for comparison, the City of Lakewood has furnished us the following data on their incinerator plant covering a 12-year period. This plant has been set up as a model for efficiency in both collection and disposal of garbage and refuse. The plant has a capacity of 150 tons in 24 hours which is twice the capacity of the plant we propose to build:

Cost of building, less land	$106,000
Number of employees in plant	5
Number of trucks in collection	6
Number of employees on trucks	30
Tonnage of garbage and refuse per year	21,000
Unit cost per ton for collection	$4.30
Unit cost per ton for disposal	$1.12

On a comparable basis the City of Cuyahoga Falls



Layout of Cuyahoga Falls incinerator.

might expect to have an investment in an incineration plant that would be distributed as follows:

Cost of building, less land	$82,000
Number of employees in plant	2
Number of trucks in collection	3
Number of employees on trucks	9
Tonnage of garbage and refuse per year	5,000
Unit cost per ton for collection	$4.30
Unit cost per ton for disposal	$1.12

Detailed figures for cost of collection and disposal have been furnished by Lakewood. These may be summarized as follows for the 12-year period, 1932 through 1943. A total of 193,914 tons of refuse were collected, varying from 11,810 tons in 1933 to 21,011 tons in 1941. The costs for supervision of collection averaged 16.36 cents per ton, ranging from 9.95 cents in 1935 to 33.81 cents in 1943. The labor cost for collection averaged $3.751 per ton, but varied from $3.39 in 1934 to $5.227 in 1943. Fuel, light and supplies averaged 2.48 cents per ton, and truck repair and parts 6.29 cents. Gasoline and oil averaged 13.55 cents per ton, garage rent 3.50 cents, and insurance and bonds 10.24 cents. The total cost over 12 years for all of these items averaged $4.1761 per ton of garbage collected. Extraordinary equipment expenses of 12.70 cents per ton should be added to this, making a total of $4.3031 per ton as the 12-year average for garbage and refuse collection. The low year was 1933, $3.808 per ton, and the high year 1943, $5.9454.

Similar figures on incinerator operation were furnished by Lakewood, covering the 193,914 tons incinerated. Supervision averaged 8.57 cents per ton with a low of 4.40 in 1939 and a high of 12.20 in 1933. Labor costs averaged 71.84 cents per ton, ranging from 63.19 in 1934 to 85.71 in 1936. Fuel, light and supplies averaged 11.80 cents per ton; the services of a weighmaster 3.28 cents per ton; and insurance and bonds .08 cent. Maintenance labor averaged 6.04 cents per ton and repair material 10.94 cents. The total average cost of incineration was $1.1195 per ton, varying from 92.89 cents in 1940 to $2.2319 in 1936. The 1943 cost was $1.2295 per ton.

Other operating analyses have been maintained, of which only a few will be given. The average load of garbage in tons in 1943, was 2.14, but varied from 1.66 in February to 2.47 tons in June. The average load of garbage over 12 years was 2.55 tons. The average load of other refuse was 0.94 ton in 1943, varying from 0.86 ton to 1.05 tons. Very little coal was used, the average over the 12-year period being 2.5 pounds per ton of material incinerated.

In order to estimate accurately the amount of garbage likely to be collected, figures were obtained from 48 communities. The median was 235 pounds per capita per year; for 6 cities having populations of 17,713 to 36,364, it was 278 pounds; and for 4 Ohio cities, it was 249 pounds. (See also PUBLIC WORKS, Feb. & June, 1940—Ed.) Cost data on collection were obtained from 9 Ohio cities. These included $7.07 per ton for East Cleveland, for all expenses, with collections from the back door; $3.92 per ton for Akron, not including depreciation, for alley or back-door collection; $3.50 per ton for Youngstown, for back-door collection; all items of expense included; $5.97 for Cleveland; and $3.47 for Columbus, all expenses included, for back-door or alley collection.

The following is a complete analysis of the probable costs to the city of Cuyahoga Falls for building an incinerator and putting in operation a collection system, together with data on amortization.

In making the estimate, the following data were assumed:

a. Cost of plant, 75 to 80 tons/24 hours.	$82,000
b. Cost of trucks, 3 = $2500	7,500
c. Total cost	$89,500

d. Interest rate, 1.5%
e. Amortization of plant over 20 years, 5.825% per year
f. Amortization of trucks over 6 years, 17.553% per year

The annual cost of collection, based on 312 days per year, is estimated as follows:

a. Amortization of trucks, $7500 = 17.553%	$ 1,315.48
b. Operation of trucks	
3 for 7 months, 25 miles/day @ 6¢, 182 days	819.00
2 for 5 months, 25 miles/day @ 6¢, 130 days	390.00
Insurance on trucks, 3 @ $80	240.00
c. Labor, driver $8; 2 helpers @ $7	
3 trucks for 182 days; 2 trucks for 130 days	19,732.00
Total cost of collection	$21,496.48
Estimated 5,000 tons, cost per ton $4.31	

The annual cost for incineration is estimated as follows:

a. Amortization of plant and site $82,000 @ 5.825%	$ 4,776.50
b. Maintenance of plant, 1% of $82,000	820.00
c. Labor, 1 man @ $8; 1 man @ $7, 312 days each	4,680.00
Total annual cost of incineration and amortization	$10,286.50
Estimated, 5000 tons, cost per ton $2.06	

The total annual cost thus amounts to $31,782.98, which amounts to $1.36 per person per year.

The following points must be taken into consideration in planning the construction and operation of a system of garbage and refuse collection and disposal:

(1) The refuse collection problem which consists in the necessity for the removal of refuse, responsibility for collection, standard of service, cooperation of householders, effect of disposal methods, seasonal variations, collection methods, collection equipment, importance of planning operations, administrative problems, and the value of good public relations.

(2) The preparation of refuse for collection is very important and should be so stated in any legislation that is prepared governing collections.

(3) It is very important that a complete record be kept of the amount of refuse collected, the cost of collection, and incineration and all information that would tend to show the cost of operation of a refuse disposal system. This information is necessary in the preparation of a budget for successful operation.

(4) And last, but not least, is the matter of public relations, the policy established by the city in operating the refuse collection and disposal system, the influence of personnel practices, employee contacts with citizens, such as personal and telephone, the handling of complaints, the education of the public, and the securing acceptance by the householders of the regulations as established to operate the collection system successfully.

Bridge Maintenance and Betterments

A small crew of picked maintenance men is continuously employed by the Bridge and Structure Division, Wayne Co., Mich., to repair and maintain existing structures. These men form the nucleus of a larger crew recruited from other divisions when necessity arises through a major accident or failure. Periodic inspections are made of all structures in order to correct at the earliest possible date any defects and thus avoid more costly repairs or reconstruction.

The Municipal Airport at Clinton, Iowa

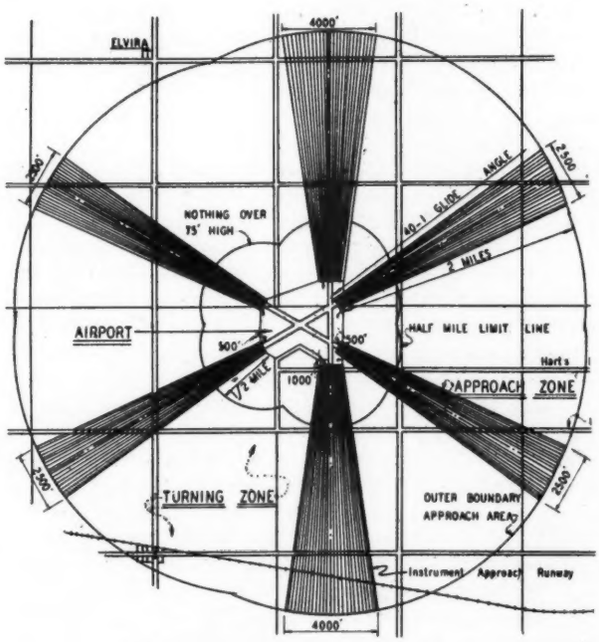
"We haven't done a great deal except to provide a safe place to land and take off. Labor and materials are so critical around here that we can't do much construction work—just get the place ready for the flyers who want to get going."

By BENTON R. ANDERSON

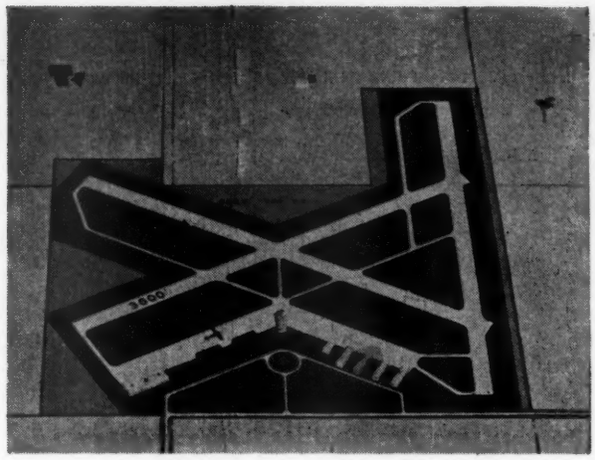
City Engineer

AT the general city election held in March, 1944, the voters of Clinton approved a bond issue of $200,000 for the acquisition of land and construction of a municipal airport. At the same election the voters approved the appointment of an Airport Commission of five men to manage the affairs of the airport. The vote on both issues carried by about a three to one majority. The mayor appointed the members of the commission and they proceeded to select a suitable site for the airport. The City Engineer and his staff made surveys of three sites and prepared detailed plans for each one. The first site surveyed though close to the city, was rejected because smokestacks, water tanks, high-lines and the river bluffs presented obstructions and hazards which were considered too dangerous for a good airport. The second site, further from the city limits, was hemmed in by the main line of the Chicago and Northwestern Railroad, the Lincoln Highway, and REA transmission lines. The site also was occupied by several sets of elaborate farm buildings, which would have been quite expensive to acquire and wreck.

The third site, which was finally selected and acquired, is located five miles west of the city, in the center of a four square mile area, free of obstructions, and on a flat divide between three water-sheds. The surface has enough slope to provide good drainage, but level enough to be used for an airport, without heavy grading. The existing runways, as laid out, conform to a master plan. Extensions can be made at any time by acquiring additional available land. Runways can be extended to a full mile in each case, if necessary.



Approach area zones, Clinton airport.



This is the way the Clinton airport will look to the aviator.

Surveys were made and complete plans prepared as required by the CAA and the Iowa State Commission. The site was approved and the city proceeded to acquire the 160 acres of land by appraisal and purchase. An appraisal board was agreed upon and the city paid $35,500, according to the report submitted. By the time the land was acquired, it was almost too late to seed down the area, but the commission went ahead with the work. The runway area was seeded down to timothy and oats. It turned out to be a good crop and a smooth surface existed when the oats crop was harvested.

About $15,000 has been spent in cleaning up the area and installing the minimum facilities required for its use as an airport. The CAA has recommended to Congress an appropriation of $616,000 for further grading, drainage and paving of the runways. For this reason, the city has deferred action toward paving the runways until Congress determines whether or not the appropriation will be made. Therefore, the runways were reseeded with blue-grass and red-top and now are covered with good turf. The general program during the past year has been based on putting the field in good usable shape and meeting the requirements of the CAA.

Other work done during the past year includes renovation and improvement of the residence used by the airport manager, L. A. Straley; installing lights, heat and utilities in the office; remodeling an old building into an office and shop; improvement of a drilled well, with electric pump and piping to furnish water; installation of two septic tanks for sewage disposal; constructing a macadam access road from Highway No. 30; installing telephone and power service; and providing gasoline service.

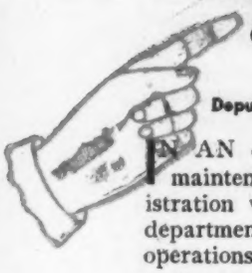
All fences, brush, trees, stumps and old buildings were removed from the area. The hangar area was graded and surfaced with macadam; where needed, the runways were graded and leveled, and marked with standard markers. One hangar building 40 ft. by 100 ft., 14 ft. high was completed, and 6 individual

hangars are under construction. Ten airplanes have been housed at the field, in addition to transient planes which have made use of the facilities. As soon as conditions permit, it is planned to proceed with the Class 3 development program.

The members of the airport commission are Homer I. Smith, Chairman; Paul F. Nadelhoffer, Secretary; Lloyd L. Peterson, Leo P. McEleny and George M. Curtis.

According to the 1940 census, Clinton had a population of 26,270. It is 150 miles due west of Chicago, on the west bank of the Mississippi River at the point where U. S. Highway 30 and the C. N. W. Railroad cross the river.

Highway Maintenance Costs and Operating Methods



J. S. BRIGHT

Deputy Commissioner, Public Roads Administration

IN AN effort to arrive at comparative costs, field maintenance engineers of the Public Roads Administration were asked to secure from State highway departments such data for individual maintenance operations on portland cement concrete pavements as were readily available. A description was also requested of materials and practices used on the operations studied. This progress report, which was presented at a meeting of the Highway Research Board and summarized in *Highway Abstracts,* furnishes the results of the survey and also an analysis of cost on several other maintenance operations. The conclusions are:

1. Maintenance expenditures in the United States of six tenths of a billion dollars per year on highways, roads and streets are of such magnitude as to emphasize the need of revaluing present maintenance practices, materials and equipment used to insure the highest degree of economy and efficiency.

2. Comparisons are now hampered by a lack of uniformity in units of measure in maintenance cost keeping.

3. Comparing costs on a lineal foot basis of filling joints and cracks in concrete pavements develops the range of costs as from ¼ to ⅝ cents per lineal foot. There is an indication that with increase in age beyond ten years the costs per mile increase quite noticeably in the maintenance of joints and cracks. There are also indications that machine methods are quite markedly more economical than hand operations, possibly permitting a saving of 50 per cent.

4. The patching of concrete pavements with bituminous materials costs from $0.25 to $1 per square yard. There are no satisfactory data as to the life of the patches.

5. The cost of patching concrete with concrete ranges from $4 to $6.70 per square yard. Work performed by State forces costs from 80 to 90 per cent of the cost by contract. There are indications that the cost per square yard of concrete patch decreases with the increase in size of the patch.

6. The cost of drilling holes in concrete pavement for mud-jacking ranges from $0.07 to $0.23 per hole. Information on the cost of slurry, including pumping under the pavement, is meager; probably it is in the neighborhood of $10 per cubic yard. Information on the cost of pumping asphaltic mixtures under the pavement is also meager but is probably around $0.12 per gallon.

7. The reports on shoulder maintenance are not conclusive but costs vary with the type and the width of shoulders. As an illustration, one State reports the cost of maintenance of 8-foot turf shoulders as approximately $94 per mile. This includes $19 for mowing, $50 for machining or rolling high places, and $25 for patching and seeding. The maintenance of crushed rock shoulders seems to be generally the most economical, ranging from $25 to $70 per mile.

8. Cleaning and shaping of drainage ditches, as would be expected, is reported to be more economical by machine methods than by hand methods. Useful comparisons can be made only when data are available on maintenance of ditches of similar design and in similar soils.

9. Cost of repainting of center-line traffic stripes indicates economy in the use of the broken center line in lieu of the continuous line. One State indicates a saving of 55 per cent.

10. An analysis of maintenance expenditures over a period of years on representative sections of road discloses that on the average, 45 per cent of the expenditures are made for direct labor, 21 per cent for materials, 25 per cent for equipment, and 9 per cent for overhead.

Rock Asphalt for "Deslicking" Highways

The use of rock asphalt in small amounts for "deslicking" work and seal courses, has been developed by the Kentucky Department of Highways. Recent inspections of this type of work show that good results have been obtained. Treatments of from two and one-half to five pounds per square yard have proven entirely satisfactory when placed on glazed bituminous surfaces, and heavier treatments of from ten to twenty pounds appear to make satisfactory seal coats on the more open, dry surfaces. Such treatments are considerably cheaper than the conventional fifty to sixty pound per square yard machine-laid surfaces and probably will be applied more extensively as a pavement "deslicking" measure in the postwar period, with its attendant increase in automotive speeds.

Sulphite Waste Liquor Treatment

The National Council for Stream Improvement has undertaken two projects in connection with waste sulphite liquor disposal. These are the trickling filter and river aeration projects. Both of these activities are centered at Wisconsin mills and at the Institute of Paper Chemistry.

In the trickling filter process, waste sulphite liquor is treated and the biochemical oxygen demand is satisfied before the waste liquor passes into the receiving waters. This project has passed from the laboratory stage to a 15-foot diameter filter pilot plant at the Consolidated Water Power and Paper Company's mill at Appleton, Wisconsin.

In the river aeration process the stream's deficiency in dissolved oxygen is satisfied by diffusing large amounts of air into the river below the point where the waste sulphite liquor is discharged. Results to date show that this system can, under certain conditions, accelerate stream recovery to a marked degree since the diffused air appears to reduce rapidly the B.O.D. of the stream water as well as add a considerable quantity of dissolved oxygen. Both these projects are under the direction of Dr. Averill Wiley who has carried on similar activities for a group of Wisconsin mills for several years.—*The Paper Trade Journal.*

Water-Borne Outbreak of Gastroenteritis In an Industry

The apparent cause of this epidemic was a cross-connection between potable and non-potable supplies.

The first serious water-borne gastroenteritis in Indiana since the epidemic at Berne in the spring of 1943 occurred during January, 1946, in an industry in a small town in north-central Indiana. Approximately 30 out of 100 employees in the industry were affected. A cross-connection between a polluted surface water supply used for industrial purposes and a potable drinking water supply was apparently the cause of the epidemic.

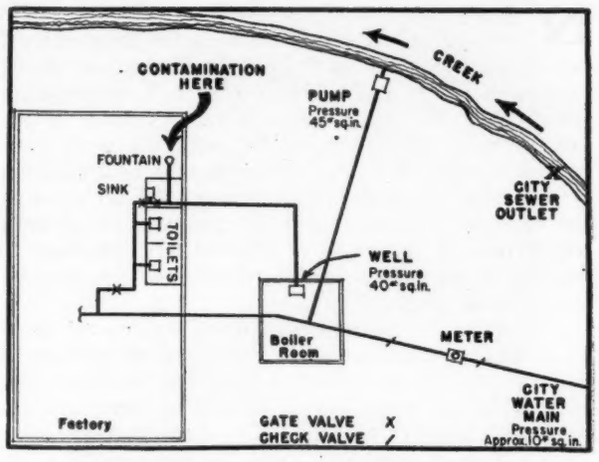
This industry had three sources of water supply: a small well used to supply a single drinking water fountain in the factory; a near-by creek, water from which was obtained below the outlet of the town sewers; and the town public water supply. The latter two supplies were connected inside the plant and both were used for industrial purposes. Two check valves were installed near the meter pit to prevent backflow of this water into the town water mains. Three gate valves ordinarily separated the industrial water system from the drinking water system.

In the early part of December, freezing weather caused the shutdown of the creek pump. The town water supply was then the sole supply for industrial purposes but pressure on the town system was insufficient to flush toilets due to the small size of the service main. Consequently, two of the three protecting gate valves between the two systems were opened and the well water was used in the toilet rooms. The third valve may or may not have been left closed. Later, weather conditions permitted the use of the creek pump. The pressure afforded by the creek pump was 45 pounds per square inch while the well pump was set to shut off at a pressure of 40 pounds per square inch. It is probable that pressure in the drinking water line was also reduced by operation of flush valve toilets.

The first reported case of an employee suffering from extreme intestinal cramps, diarrhea, nausea and vomoting occurred on January 19. From that time until January 23, there were 19 reported cases, verified by plant time cards as to absentees, and by a local physician. In addition, it is estimated that 10 or 12 other employees were affected to a lesser degree. Only two cases among townspeople outside of the industry were reported and both were in families of employees. Several of the affected persons had two attacks.

Water was the only common food or drink consumed by the employees. The possibility of chemical or mineral poisoning was not overlooked, but investigation eliminated this factor.

Water samples were collected on January 23. It was apparent that flushing of the system with well water and city water had removed most of the traces of contamination although some contamination was still evident in samples collected from the drinking water line. Another sample collected on January 24 from the fountain was of satisfactory quality and a sample from the industrial water line, which had certainly contained the polluted water, was also satisfactory.



Map showing method of contamination.

The cross-connection between the drinking water system and the industrial supply has been broken and only city water is used in the industrial system. The industry has been asked to eliminate the cross-connection between the surface water supply and the public water supply if the surface supply is to be used in the future.

This outbreak was reported by Leo Louis, senior sanitary engineer, Division of Environmental Sanitation, in the Monthly Bulletin of the Indiana State Board of Health.

Engineering Books of Long Life

A recent discussion of the length of service rendered by engineering texts, which centered around Folwell's *Sewerage*, with a useful life of 48 years to date, was referred to John Wiley & Sons, Inc., publishers of technical books. We are indebted to W. O. Wiley for the following information:

"There are few textbooks on our list with any longer life (than Folwell's *Sewerage*), one being Searles' 'Field Engineering,' published in 1880, and another Merriman's 'Treatise on Hydraulics,' published in 1889. In the non-textbook field, however, we have several books with even longer life, notably Dana's 'System of Mineralogy,' originally published by the author in New Haven in 1837, and in 1844 published in a Second Edition by Wiley. This mineralogists' 'Bible' is now under revision, in fact the first volume has already appeared. Another old book is Butts' 'Civil Engineers' Field Book,' originally published in 1886. It is still quite extensively used by certain highway departments and certain railroads. Still another is Wellington's 'Economic Theory of Railway Location,' published in 1887."

A Sanitary Engineer's Part in the War

One Sanitary Corps Officer's contribution toward winning the war in the Pacific. A personal narrative of the part played by the Malaria Control Units from Guadalcanal to Tokyo.

By CAPT. A. JOHN HORN, Sn C.

NOW that the war is over, it is possible to recount some of my experiences during the three years I served as a member of the Armed Forces, the major portion of which was spent overseas as a commanding officer of a Malaria Control Unit. As some of the readers may not be acquainted with the work done by the Sanitary Corps in protecting the health of our troops, I will outline briefly some of the activities of these special units, and the wide diversification of work undertaken by them and by the Sanitary Engineer in command, especially in the Southwest Pacific and SouthPacific areas.

The author's experience in mosquito control prior to assuming command of a Malaria Control Unit is summarized here so that the reader may see that experiences in one section of the world at times are not applicable to other sections. Also, Army public health work differs considerably from civilian public health in that, under Army conditions, large numbers of personnel are usually congregated in small areas; overcrowding is common; facilities, particularly in the front areas, are meagre; supplies are often slow in arriving and improvisation is the order of the day. Under such conditions the sanitary engineer was forced to be ingenious in order to accomplish his task and to utilize salvaged materials to the maximum. This necessity gave rise to the expression "an empty oil drum has more value than factory made equipment" and subsequently it will be shown why such a statement originated.

The early days of the African campaign found the airports of Brazil and British, Dutch and French Guiana to be vital links in an air transport line to the front. Most of this area was backward in sanitation and heavily infected with all forms of tropical diseases. Sanitary engineers were sent to correct such conditions and to make safely livable those areas required for the base troops.

Besides the immediate base areas, it was necessary to control, as much as possible, the nearby towns and cities which would be visited by the troops stationed there. In Belem, at the mouth of the Amazon, where the author was stationed, waste water from the houses ran through narrow ditches from the house to the gutter; the daily rains and the vultures were our allies in sanitation. There were sewers built in many portions of the city, some connected to trunk lines and some with no outlet. Hence the catch basins were always full and the overflow found its way eventually to the river. Water supply was of a dubious quality; ice cream was suspicious but, with the constant heat, one well knew that it was practically impossible to prevent soldiers from eating ice cream. The best solution was to try to sell minimum standards to the manufacturer and purveyor. Discouraging as all this may sound, the work done was noteworthy; drainage ditches were dug to remove standing water from the runway areas, swamps were dried up, sewer outfalls were led to the river with tide gates made of wood to prevent backflow. Each month showed definite improvements until at war's end Belem, historic city of tradition nestling on the Equator beside the muddy water of the Para (branch of the Amazon river), was livable.

We did not need to go to the jungles of Brazil to find out about malaria, for right here in the United States it was a problem. Like so many Americans, I had paid no attention to malaria as an American disease but catalogued it for tropical islands and jungles; and how astounded I was to be assigned as a malaria control officer at one of our large camps in Louisiana. Here a program of control was already underway consisting of oiling, drip barrels, brushing and drainage carried on by a civilian crew under Sanitary Corps direction. An accelerated program was undertaken consisting of grading beneath buildings to eliminate breeding, stream straightening, constructing ditches and lining them with precast slabs, and setting up a malaria school for the personnel of two Army divisions, both enlisted men and officers. The average cost for mosquito control work at this one camp in Louisiana was about $50,000 per year. Again ingenuity was essential to do the most with the smallest amount of material. The precast slabs went a long way in providing permanent ditching and eventually reducing the yearly cost.

Soon came change of orders that brought me to New Caledonia and then to Guadalcanal to command one of the new Malaria Control Units. Fortunately, previous Army experience was of assistance in this new undertaking. There at Guadalcanal I saw what other Malaria Control Units had done—road drainage, stream cleaning, and outfalls made of gas drums to beyond wave action area. In the early days, soldiers wore full uniforms after sundown, heat or no heat, and carried and used mosquito repellent, or they were not admitted to the movies. In one CB unit I used to inspect, the commanding officer had a rule that if a man was found violating malaria control measures he was made to act as a malaria inspector each night from sundown to light, and unless he found a violator to report, he served a minimum of fourteen days. Sometimes extra duty was the punishment, or even reduction in rank, for it was imperative that all measures be used to control this most militarily important disease. The Navy and Army were now convinced that, while atabrine had a place in war, malaria control was the true preventive. Casualties from malaria and filariasis in the early days of the war had exceeded our battle casualties, but Guadalcanal soon became livable, and much later was even to forget about malaria.

My unit was next assigned to the island of Emirau, a tiny coral spot north of Kavieng, south of Mussau and east of Manus, in the St. Matthias group. It was of vast strategic value on the road to Manila and Tokyo. This tiny coral island only seven miles long and three miles wide at the widest point, and aver-

aging in width about one and a half miles, contained two important airfields. Statoned there were about 22,000 soldiers, sailors and marines. There were some twenty swamps on the island, ranging from less than an acre to seven acres in size, and mosquito breeding was prolific. The natives were heavily infected with filariasis and were moved to the island of Mussau as a precaution; such a seed bed of infection was too dangerous to have around congested troop areas.

At first a heavy promiscous oiling of all standing water was undertaken as a preliminary, temporary measure; later this was followed by dynamite ditching to drain most of the swamps to the sea; where the swamps were below sea level and undrainable, the ditches allowed the swamp to flood with salt water and thus destroy the fresh-water mosquito breeding grounds. Here as elsewhere empty gas and oil drums were a lifesaver, for with the heads removed they provided us with culverts under roads and outfall sewers to the sea. Malaria ceased to be a problem within eight weeks after the Malaria Control Unit began to function. Three months after our landing there, and for four months thereafter, no Anophelene breeding was found on the island. Again our work had saved many soldiers from acquiring this disease.

Besides our malaria control work we made a hydrological study of the water sources on this island. The coral island lay atop an old volcanic mountain with a coarse, porous coral that was unusual. When fresh cut it was very porous but, as it was partially soluble, water would redeposit and seal off the porous spaces and thus form a water pocket. Shallow wells were dug in many places and empty gas drums, with heads removed, were installed as well casing with each drum welded to the one above. This proved a very effective means of water well protection, considering the necessity of utilizing only available material. The water consumption on this island averaged 45-50 gpd/capita, one of the highest rates for the area. Portable filters and chlorinators were used and attempts were made to maintain a .5 ppm chlorine residual at the point of use, as determined by a comparator.

One form of ingenuity employed in our work on malaria control was the pressure sprayer. Regular equipment available was not satisfactory as a pressure sprayer, so a substitute had to be found. Regular 500-lb smoke bombs were the answer; by welding a hose fitting on the discharge and a salvaged air inlet tire valve on one of the fill caps, it was possible to put 35-40 gallons of diesel oil into the bomb and fill it with compressed air to 65 lbs. One bomb so filled was mounted on the rear of a jeep, or two in a weapons carrier, and sprayed oil a considerable distance. Road rut breeding was always a problem, but with a bomb mounted on a weapons carrier and driving it slowly, the spray operator could cover many miles of road ruts with a uniform oil coating every day.

Our trail led from Emirau to Bougainville and thence on to Luzon, Philippine Islands, where the Malaria Control Units were to function as True Public Health Units. Only a few units were assigned to Manila but others undertook equally diversified work. At San Fabian and San Fernando del Norte, Malaria Control Units were used to construct general hospitals of bamboo framing with interlaced slats of bamboo. Experience was gained in the use of this new material, and sanitary engineers supervised native Filipinos in constructing ward and clinic buildings. To notch, fit and erect bamboo frames and trusses called for a lot of ingenuity but the buildings held up, served their purpose and survived the rainy season. The building

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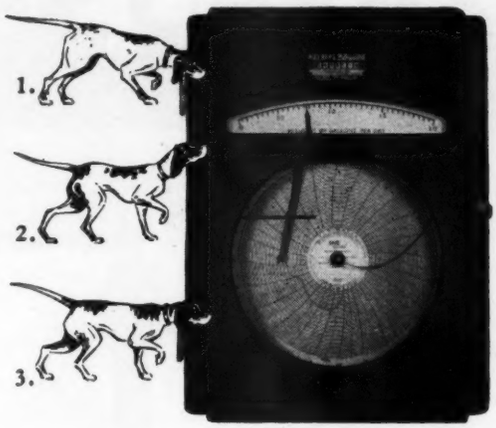
Another member of the Builders thoroughbred "family" of instruments is the Flo-Watch which totalizes, indicates and records — with all three dials in one compact instrument.



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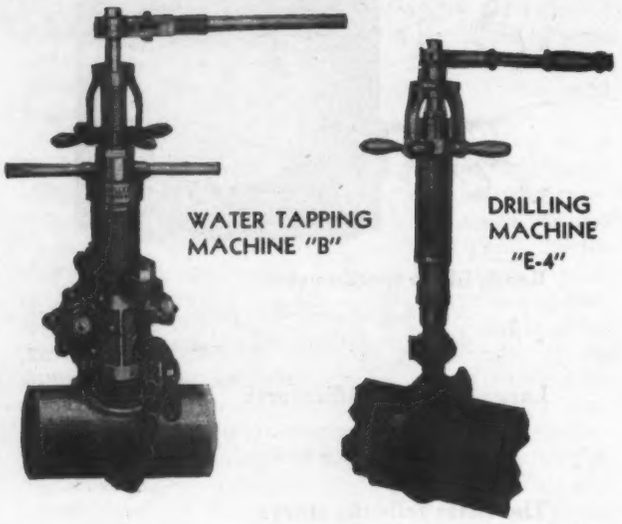

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of them gave the engineers a good deal of managerial and supervisory experience under difficult conditions, for many of the natives speak only the local dialect.

A small group of Malaria Control Units were ordered to Manila for the purpose of setting up a Health Department. My unit was ordered to South Manila, that is, south of the Pasig River, where destruction had been heaviest. It is here that the City Hall, the Government buildings, Intramuros or the walled city, the Manila Hotel, the Ermita, Pasay and Santa Ana areas are all located. Here was where most of the dead were found. Here the flies and stench of death and fire made eating a trying ordeal. Our orders were to clean up and to install the services of a modern health department. It seemed a formidable task when one saw the refugee areas, the 30,000 dead, the flies, garbage, filth, dirt—and yet that was our task. Filipinos were recruited as laborers and organized into squads under the supervision of an enlisted man of the Malaria Control Unit. Once more our old friend the empty gas drum went to work, for with one head removed it became a garbage can to be placed on street corners with stenciled instructions to put all garbage therein. Garbage collection schedules were set up, and garbage dumps located and marked and DDT'd daily for fly control. Each garbage can received a spray of DDT when empty to prevent fly breeding. Trash collection and street cleaning followed in short order, and then spray crews went from house to house spraying DDT in diesel oil on the exterior and DDT in kerosene on the interior surfaces. Highly effective fly control was accomplished in a short time. A house-to-house survey of population, sanitary fixtures, garbage and waste disposal soon permitted us to plot our areas of greatest potential of disease and to concentrate in those areas. Refugee homes and billets were cleaned up and sprayed, hospital ambulance service installed, and storm water and gutter catch basins cleaned out prior to the onset of the rainy season. Drainage canals were choked with water hyacinths but many miles of them were cleared before the rains came.

In a relatively short period of time all of the services were functioning and the civilian population was being helped back to normalcy. Our once formidable task soon became part of a smoothly functioning Manila Health Department, and when it was turned over to the commonwealth government it was an actual operating unit. Although this work was principally for the civilians, it contributed very largely to Army public health also, for in cleaning up the city, in instituting minimum standards of sanitation in restaurants, in controlling flies and mosquitoes, and in cleaning up private homes, we helped to protect the soldiers from dysentery, dengue, and other diseases. No major epidemic broke out, even though war had disrupted all normal functions. The experiences gained were priceless, for the problems that arose were many and varied.

V-J day was fast approaching and we were sent to Tokyo to be one of the early units in the occupation of Japan. Perhaps little need be said of this, for our principal mission was to DDT all buildings to be used by the occupying forces as billets and offices. Most of the buildings were modern, fireproofed, brick and steel and our task was relatively easy and our stay most enjoyable. Supervision of messes also was given to us, so standards of sanitation could be taught to the Jap employee as well as the Army supervising cooks.

After the long journey and the three years' time spent in the Sanitary Corps I can say that, while I did

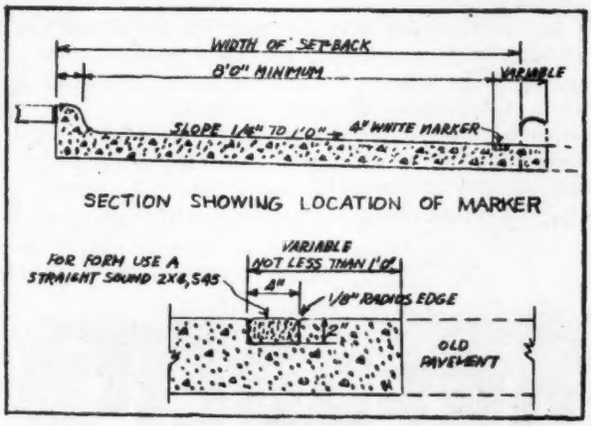
not design any large water or sewage treatment works, or even undertake any major engineering problem, yet the supervisory and managerial experience acquired, the need for making out with whatever materials were available, the necessity to use ingenuity in place of specific equipment, the varied problems met only under the duress of war, and the pleasant associations, made the experience worth while. No great feats of engineering were accomplished, yet what was accomplished was essential and the experience gave one a better understanding of engineering.

Standard White Traffic Marker Used by Oklahoma City, Okla.

By RALPH LEE
City Engineer

The accompanying drawing and specifications are for a white traffic marker to be placed on paved cutbacks on narrow streets that are not wide enough for angle parking. We are just starting the use of this method and propose to require cut-backs of 8 ft. or more. We will require parallel parking for widths of 8 ft. to 15 ft. and allow angle parking for cutbacks 15 or more feet wide.

The specifications for these white markers are as follows: The materials shall consist of white portland



Details of Oklahoma City Marker.

cement and white sand. The mixture shall consist of one part white portland cement and two parts white sand with sufficient water to form a plastic mix. Immediately after the concrete is placed and struck off a straight, sound board shall be embedded in the fresh concrete. The pavement edge shall be edged with a 1/8" radius edger. As soon as the concrete has hardened sufficiently to stand, the marker form shall be carefully removed. The bottom of the recess shall be roughened and the white mortar placed immediately. The white mixture shall be compacted with a wooden hand float and finished with a heavy steel trowel then edged with a 1/8" radius edger. It shall then be cured using the same method as the remainder of the concrete.

Studies Cost of Garbage Grinding

A study of the feasibility and cost of disposing of ground garbage through the sewerage system of the Minneapolis-St. Paul Sanitary District, made at the University of Minnesota, shows that the sewage treatment works can successfully handle all of the garbage at a cost equal to one-fourth of the present sewer rental charge. Also that the addition of ground garbage to the sewerage system would increase the quantity of solids in the sewage by about 22 per cent but

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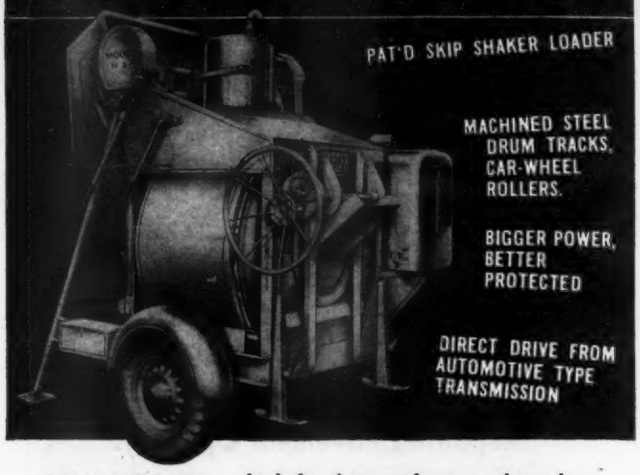
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that this would have no harmful effect on the sedimentation process. It was estimated that if all homes in both cities were to install garbage grinders the cost of sewage treatment per capita would increase from 37 cents a year to 48 cents, or an increase of $87,000 a year in operation and maintenance costs while the construction of added facilities to plant would cost $96,000.—*Public Management.*

Wisconsin Health Department Organization

A reorganization of the Wisconsin State Board of Health was effected at the beginning of 1946. There are now five sections or divisions: Sanitary Engineering; Preventable Disease; General Administration; Local Health Service; and Maternal and Child Health. Under Sanitary Engineering, with Lew Warrick as director, are also placed stream pollution, plumbing, well drilling, slaughterhouses and rendering plants.

Repairing Pavement Openings

(Continued on page 21)

portions of admixture, if used, must be carefully controlled. The mechanical mixing time should not exceed two and one-half minutes in summer temperatures. Where the mixing time is in excess of this period, the mixture may set up in the drum of the mixer, or before the final tamping of the repair section has been completed.

Proportions.—For rapid acceleration at temperatures above 70° Fahrenheit, a 1½% calcium chloride solution may be used. At temperatures between 50° and 70° Fahrenheit, a 2% solution; 32° to 50° Fahrenheit, a 2½% solution; and at temperatures from 24° to 32° Fahrenheit, a 3% solution. No two portland cements will, however, react the same in combination with such an admixture, but for average working conditions these rules can be followed.

Preparation of Solution.—The admixture, if calcium chloride, should not be added to the mixer drum in a dry condition. It must be added in solution in order that a thorough distribution of the salts may be assured. If added in the dry state, isolated portions containing the admixture may occur and quickly set up, not only fouling the mixer drum, but if placed in the repair section causing areas of unequal initial set. To prevent any unequal proportions, the solution should be prepared accurately by some standard method before the admixture is placed in the mixer drum. The calcium chloride solution is not to be used in addition to the desired water ratio. If a total of 4 gallons of water is required, this must include the calcium chloride solution.

A concrete mixture containing calcium chloride, having been placed and finished to the proper surface, requires no careful curing, but during high temperatures the finished pavement should be protected by burlap saturated at frequent intervals to prevent temperature cracks. In plain mixtures the repair sections should be cured with wet hay or by the ponding method until the area is ready to be thrown open to traffic.

It has been found that the color of the adjacent pavement may be matched in the repair section by the use of carefully adjusted mixtures and by the incorporation of ferrous oxide in the concrete. Such a process is, however, not recommended owing to our lack of knowledge of the reaction of the concrete to such a supplemental admixture in connection with automobile oil drippings and calcium chloride, and owing to

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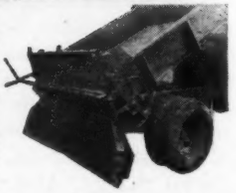

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When you need special information—consult the classified READER'S SERVICE DEPT., pages 71-73

the fact that a highly skilled personnel, not as a rule found in general work, must be used to obtain exactness. A high early strength concrete is the ultimate desire, regardless of the fact that a "crazy quilt" surface appearance may be objectionable to the traveling public. Extremely difficult methods of control are necessary to accomplish a blending of colors and it is felt that the early opening of concrete pavements is of far more importance to our vehicular traffic than the problematic results which might be obtained in an effort to please the eye. Where blending of colors is, however, considered necessary, pleasing results have been obtained by determining carefully the composition of the original pavement and incorporating in the patch cement, sand and coarse aggregate from exactly the same sources as applied in the old concrete. If the patch is placed as outlined herewithin, there should be no shrinkage of the new concrete away from the old and consequently no reason to paint the perimeter of the repair section with bituminous material. This fact, of course, improves the general appearance of the surface.

Control of Fly Breeding in Sludge

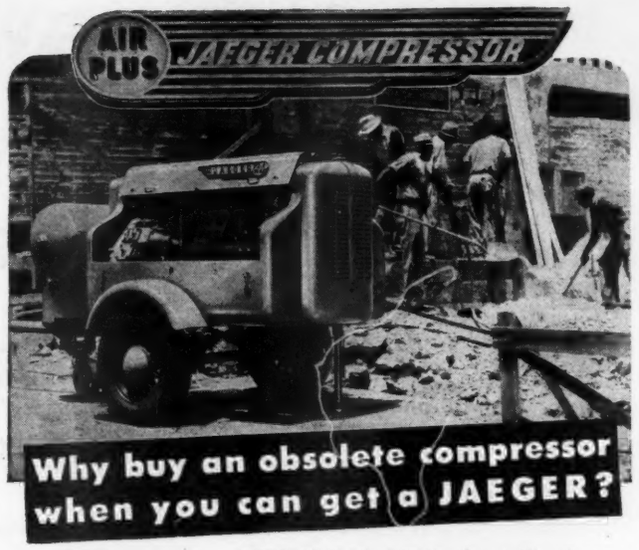
(Continued from page 24)

the table indicated that the rotenone and DDT emulsions had very little larvicidal value. However, a 100% kill was obtained with both borax and kerosene. It may be noted further that although DDT dust was only moderately effective as a larvicide, it may be expected to accomplish the control desired. This statement is based on the fact that most of the pupae produced failed to emerge and that the few adults that did emerge were dead within 2 hours.

In view of the popularity of DDT, an additional check of the larvicidal value of this material was made under slightly different circumstances, using much lower concentrations of the dust. Since a comparable sludge was not available for this check, the test was made on maggots in the bran-alfalfa-yeast culture medium referred to in the description of methods, and routinely used in rearing. Although this material is not an exact duplicate of the sludge, it has many similar physical characteristics.

In the control, 95.3% of flies emerged, 4.7% pupated but did not emerge and all survived more than 2 hours after emergence. Using 0.05 pound of 10% DDT dust (0.97 pound per 100 square feet), 43.4% of the flies emerged, 44.7% pupated but did not emerge, and none survived for as long as 2 hours after emergence. Using twice as much of the 10% DDT dust (0.10 pound per cubic foot and 1.94 pounds per 100 square feet), 21.3% emerged, 70.2% pupated but did not emerge, and all died within 2 hours after emergence. Thus although the lower concentrations of DDT dust used did not prevent pupation and some emergence of the flies, they did accomplish ultimate control in that the adults which emerged died within 2 hours.

The data presented indicate that the rotenone emulsion used as recommended by the manufacturer did not control housefly breeding in sewage sludge as well as borax, kerosene or DDT dust. DDT emulsion at the strength used was no better than the control. The application of 10% DDT dust may be reduced from approximately 15 pounds to 1 pound per 100 square feet if ultimate control rather than prevention of emergence is considered adequate.



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Public Works Digests

Water Supply · Sewerage · Highways and Airports

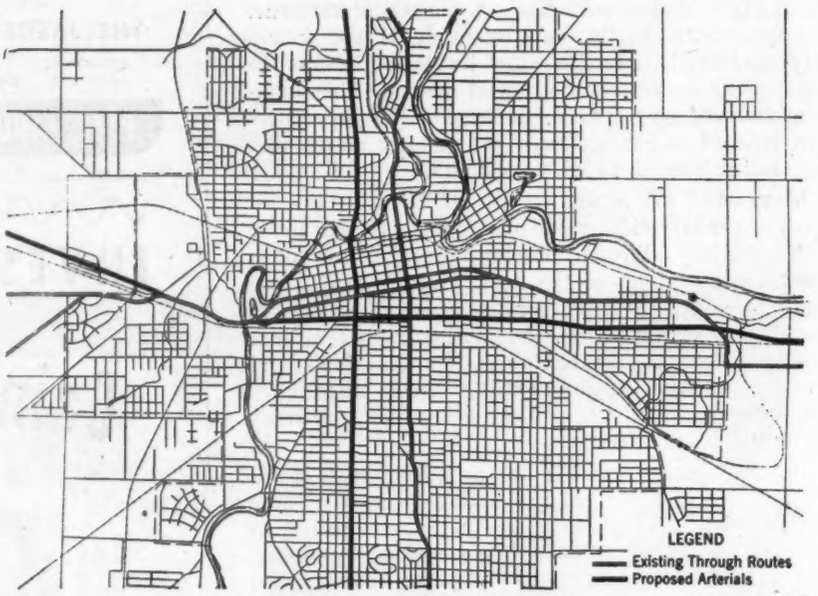
In this section are digested and briefed the important articles appearing in the periodicals that reached this office during the previous month. Appended are Bibliographies of the principal articles, in which the articles in each periodical are numbered consecutively throughout the year, beginning with our January issue.

The letter and number at the end of each digest refer to those used in the Bibliography. Numbers not found in the current Bibliography will be found in the one published the previous month.

The Highway and Airport Digest

Radio Communication In Chautauqua County

Chautauqua County, N. Y., has used the two-way radio telephone in its highway work for several years and has found it to be a means of preventing many winter tragedies as well as reducing highway operational costs. In 1941 the county had 36 snow-removal units, but war demands reduced that to 24 in 1942-43, but by adopting radio they kept the roads clear of snow. At one time, heavy plows and rotaries were often sent out automatically on highways that were known to have high drifts. The results were not too satisfactory, the slow-going equipment operating only about 30 per cent of the time. With radio, lighter and faster plows cover the road, skirting around drifts without a thought of bucking the deep snow. Instead, the driver notifies the dispatcher of the location of the drift. The dispatcher sends a rotary to the scene, and it isn't long before the drift is no more. This process continues, the lighter snow plow taking away the surface snow, the rotary plow delivering the knockout blow to stubborn drifts. Several years of experience has proved the economy of this strategy.[B18]



Courtesy A.S.C.E.

Pattern of arterial routes in a medium city.

Planning Express Highways

The fallacy of planning bypasses as a general solution of the city traffic problem has been glaringly revealed by state-wide planning surveys and other studies, which have shown that the bulk of the traffic approaching the larger cities is destined for points within the city itself and cannot be bypassed. It has become clear that traffic congestion in cities will be solved to the greatest extent feasible by the construction of facilities that permit the uninterrupted flow of traffic into and through the cities. Most traffic accidents occur at intersections, and these can be reduced by providing express highways.

Of all data bearing on planning expressways in cities, those showing the origin and destination of all traffic are most important in determining location of the expressway and of access connections. Adequate traffic data and the judgment of competent highway engineers demonstrate definitely that arterial routes should be so located that the through routes outside the city are connected with the central business district, although perhaps along the fringe of that district because of lower property costs there. In the larger cities there is in almost every case a close-in circumferential route from which arterial roads radiate in several directions. In large metropolitan areas there is an outer circumferential route and sometimes an intermediate one. Interchanges between the free-flowing arterial road and local streets should be located on the basis of traffic needs, effect on the arterial route and on the surface distributors. These distributors may need to be widened or converted to one-way operation, or cross streets to be blocked.

The pattern described above does not seem to materialize in cities of less than about 200,000, but in these, two arterial roads at approximately right angles ap-

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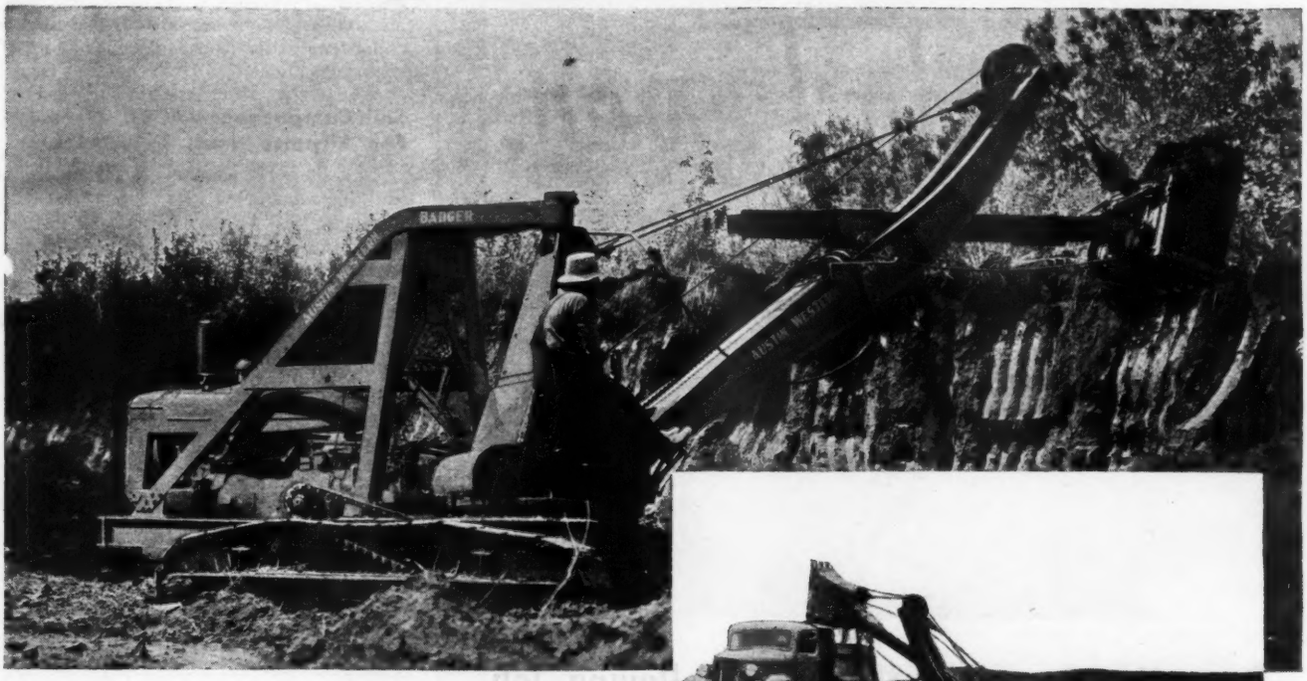

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pear to be all that can be justified. In yet smaller cities, particularly where development is strung out along a railroad, a river or an existing highway, one arterial road into and through the city generally is all that can be justified.

A surface expressway is a great improvement over any thoroughfare with all streets crossing at grade, but it is not truly a free-flowing facility. In developed urban areas, a depressed expressway is the best type. The control or limitation of access is necessary for a free-flowing expressway. To reduce to a minimum changes to utilities in existing streets, the expressway can be located between existing streets rather than widen and lower one of them. The elevated structure type of expressway is the most costly to construct; but it is more advantageous to local cross traffic and for the maintenance of vehicles.[K1]

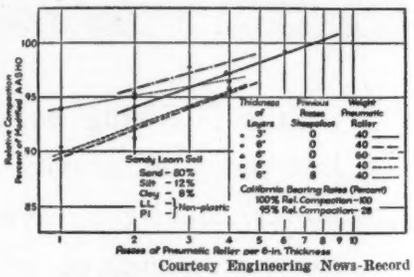
Is Keeping Cost Data Justified?

1. To determine the cost of doing work, or operating equipment. 2. To furnish records with which to determine the advisability of continued use of certain types of material or equipment. 3. To afford basis of comparison in the cost of maintaining different types of pavements, surfaces, or equipment. 4. For future estimating purposes. 5. To facilitate the budgeting and allocating of funds, and to furnish authoritative figures upon which to base legislative appropriations. 6. As a basis of comparison between state force and contract work. 7. To stimulate competition between Counties and Districts. 8. To determine administrative and overhead costs. 9. To enhance the morale of state employees from the standpoint of conserving the taxpayer's money. 10. To furnish records for Annual Reports, required by law in many of the states.

Voluminous cost records consume a great deal of time and effort, and in too many instances they are never used or even looked at. "In my opinion, the expense which can be justified in obtaining cost data should be governed entirely by the need for the data, and the useful purpose for which the data are used. Personally I think the cost should be kept to the absolute minimum consistent with useful need and mandatory requirement." [N20]

Soil Compaction For Airports

Speaking before the American Road Builders Ass'n, O. J. Porter, research engineer, California Division of Highways, stated that, as a general rule, the energy required for compacting relatively impervious soils varies roughly as the square of the thickness of the layer —in compacting a given volume of embankment, 6" layers require twice as many total passes of a given roller as do 3" layers. In compacting 6" layers of sandy loam, a 40-ton rubber-tired roller was about half as efficient as the same roller loaded to 60 tons. Heavy, cohesive soils such as clays must be placed in thin layers to expel the entrapped air readily and efficiently. Sandy soils compact readily and consume less energy than cohesive ones. Moisture is



Courtesy Engineering News-Record

Soil Compaction for Airports.

desirable for efficient compaction, but dry sandy soils can be compacted without water if rolled in very thin layers with heavy rollers. Rolling in 6" layers with heavy standard sheepsfoot rollers before rubber-tire rolling did not aid in obtaining high density.

California Highway Department specifications require that the subsoil and subgrade be highly compacted in layers not more than 4" thick for a depth of at least 3 ft. below profile grade. In cuts, the material must be removed to this depth, replaced and compacted where it is necessary to obtain high density and stability.

Discussing compacting soils by vibra-

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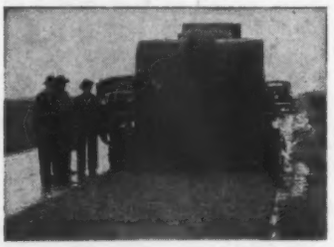

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tion, Prof. Tschebotarioff said that vibratory forces are many times more effective than static forces of equivalent magnitude in compacting sands but are not any more effective in compacting clays; that the compactive effort of a static load can be magnified several times on any soil if the load is vibrated at the natural frequency of the load-soil system—so called "resonance"; and that interposition between the vibrator and the soil of pneumatic tires or any type of springs appreciably reduces the compactive forces transmitted to the soil. It is unlikely that there could be any possible advantage in using any kind of vibratory roller equipment for compacting clay soils. To be effective, vibratory forces must be applied for some time at one spot, necessitating slow progress of the vibratory compaction equipment, and it is questioned whether such equipment would be economical for compacting sands.

A possible solution of the problem presented by deep, loose natural sandy deposits is the sinking of "sand piles," but this would probably be very expensive. However, in the case of hydraulic fills, sand piling might be no more expensive than trucking in additional fill and rolling it in layers.[E14]

Stabilization In Michigan

The Michigan highway department over a 3-year period has used stabilized materials at the rate of about 500,000 tons a year. It has produced some excellent results by blade mixing in place, but results were not uniform and it concluded that plant mixing was necessary to secure uniformly well-established roads with accurate control of all operators.

To aid in designing a mix before bids are taken, the soil engineers have, on the basis of soil type classification, located and made a material inventory of adequate sources of binder soil and aggregates in all the counties where the soil classification indicates that materials may be suitable for stabilization. The pit numbers and test results have been tabulated under counties and cross indexed with one or more names used locally to designate the deposit, and this information is available to all contractors. This tends to lower the cost and definitely increases production. High plasticity-index clays are avoided during the wet season, the lower P.I. clays being less affected by adverse weather conditions. Usually 5-15 lb. of calcium chloride or 10-20 lb. of sodium chloride per ton is added to aid compaction. Both continuous and batch-type plants are used, but the former are considered better for producing stabilized material and at lower operating costs. The output of stabilizing plants is ⅓ to ⅔ more than that of the average portable gravel plant, and the highway department requires that all materials to be used in stabilization be stockpiled beforehand to avoid delays.

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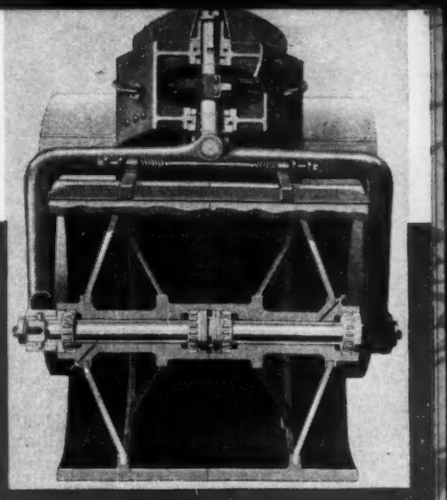

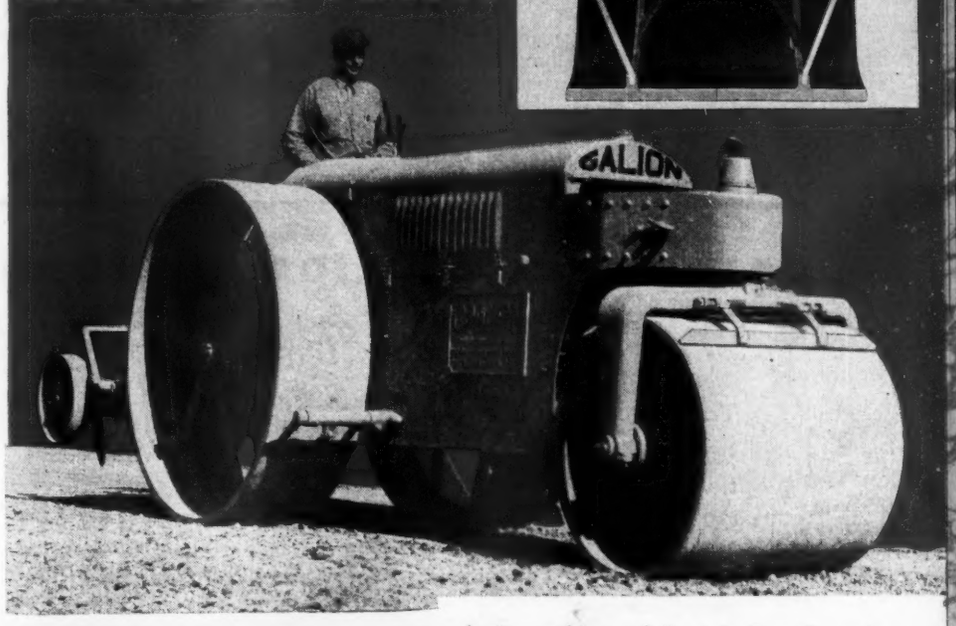

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And speaking of "out-in-front" performance--take a look at the front-end construction of this GALION Three-Wheel Roller, and note these outstanding features that mean ease of handling, economical operation, and long life.

1. Rolls are assembled with only .005 of an inch clearance which is constantly maintained. This "close-fit" retains all the advantages of a single roll while giving the worthwhile advantages of a split roll.
2. Rolls float on four large adjustable tapered Roller Bearings.
3. Mounting of the heavy king pin at top and bottom on Roller Bearings assures easy steering under all road conditions.
4. Yoke is sturdy steel casting heavily reinforced at points of strain.
5. Yoke is connected to heavy forged steel king pin by a swivel joint giving full flexibility.
6. Rolls are made of a special, tough, fine grain cast iron. The heavy steel spokes are securely anchored in rim as it is cast, giving the effect of one-piece construction.

Complete information given in Catalog No. 280. Write for your copy and names of nearest Distributors.

The GALION IRON WORKS & MANUFACTURING CO.
GALION, OHIO

GALION IRON WORKS
GRADERS • ROLLERS

are the following: 1—Stabilized base course materials should not be placed over high-capillary soils without an adequate subbase or other type of capillary cutoffs. 2—Stabilized material should not be used as a maintenance material to patch spring break-up areas. 3—It should not be placed in continued wet weather unless traffic be detoured, and material laid toward the plant to avoid construction traffic over it. 4—It should be compacted in layers not over 3" thick. 5—Sand subbases used for capillary cutoff or light sand subgrades usually require a binder soil manipulated into the top 3". 6—A bituminous surface should not be placed on a stabilized base until at least two months of dry warm weather have succeeded the laying of the latter. If a stabilized surface course is to serve as a wearing course during the wet seasons, the crown should be not less than 5" for a 21 ft. road.[N28]

Treatment Of Roadsides

Unless tested roadside improvement practices are incorporated in highway construction, about ¾ of the right-of-way will be left unprotected against washing and gullying and possible undermining of pavements. Including such improvements in the original design and construction increases traffic safety through improvements in the cross-section and design of shoulders, gutters and slopes, and of the median areas of divided highways; it selects and develops sites for turnouts, scenic overlooks and roadside parks; improves the appearance of the highway; facilitates use of advanced types of construction equipment, thus lowering unit cost of excavation, and encourages use of power-operated mowing and snow-removal equipment.

The following basic construction items may be performed most effectively and at lower cost if they are included as a part of the original highway plans, specifications and estimates: 1—Conservation and protection of major landscape features, salvage of topsoil and other materials for use on the project. 2—Grading and shaping of slope and drainage areas and protection of all disturbed areas against erosion. 3—Shoulder surfacing and widening at mail boxes and bus stops. 4—Construction of footwalks and other pedestrian facilities. 5—Development of safety and service turnout areas and waysides. 6—Construction of retaining walls, transplanting of fine trees, etc., made necessary by damage to adjacent property. 7—Planting of vegetation to facilitate maintenance operations, for traffic guidance, as snowbreaks and for other safety purposes. 8—Selective landscape thinning, tree-pruning and opening roadside views.[R15]

Postwar Contracts

The manner in which funds are allocated by the federal government for postwar work indicates that the majority of individual highway jobs will be moderate to small in size. This probably will revive the smaller organizations and produce many new ones. . . . Many new construction methods were developed during the war; some of these may continue in use but many will not . . . Construction costs are high—perhaps so high that highway officials will not be justified in letting contracts until they drop. But on the other hand, with the certainty of increased traffic and with roads in their present condition, much work seems to be imperative. Under present conditions, few contractors are in a position to figure accurately the cost of a job.[E16]

CALCIUM CONSOLIDATED ROADS
Earn Their Way!

Traffic avoids poor roads.

Improvement of such roads by calcium chloride consolidation is often followed by such rapid increase in traffic they soon pay their own way—relieving heavy traffic on parallel roads — improving property values — increasing farmers' incomes — giving city dwellers a look at nature away from the paved arteries.

Local labor may be used with local materials. These materials, consolidated with calcium chloride, provide a smooth, all-weather road with exceedingly low maintenance needs and no dust.

Consider this type of road in your future plans for Federal Aid secondary roads.

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Consolidation

Bibliography of Highway Literature

D *The Surveyor*
March 1

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10. Manufacture and Proper Use of Coated Macadam. By A. J. Lyddon. P. 186.
11. Road Traffic Signs. Committee Report. Pp. 191-192.

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12. Some Notes on Municipal Carpets. By E. A. Hackforth. Pp. 199-200.

E *Engineering News-Record*
March 21

14. Soil Compaction for Airports. Pp. 82-86.

April 4

15. Ice Prevention on New Hampshire

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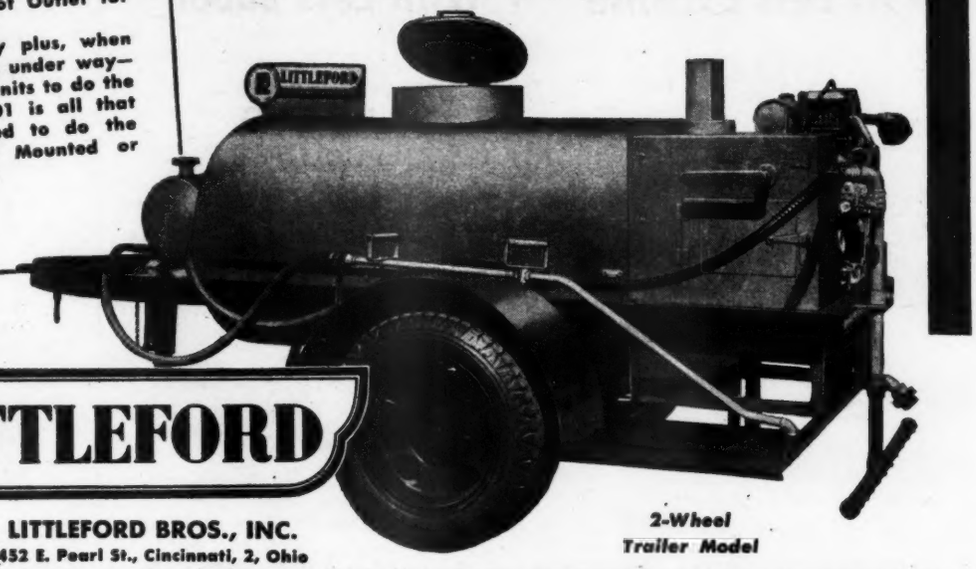
When it comes to doing a variety of those Black Top Road, Street and Runway repair jobs, this Littleford Model No. 101 Utility Spray Tank is the master of asphalt spraying units. Has a Spray Bar for small application work, a Hand Spray for patch work and a Pouring Pot Outlet for those crack filling jobs.

The 101 gives utility plus, when maintenance work gets under way—no need to take three units to do the work—the Littleford 101 is all that is needed—it's designed to do the job. Made in Trailer Mounted or Truck Mounted Models.



2-Wheel Trailer Model

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Baseal is the latest contribution by *Servicised* to the road Building Industry, a base-sealing strip as the name implies—new in purpose, performance, and design. A preformed, flexible, adhesive strip in a roll. Stops infiltration at the Danger Point at bottom of every Lateral Expansion Joint.

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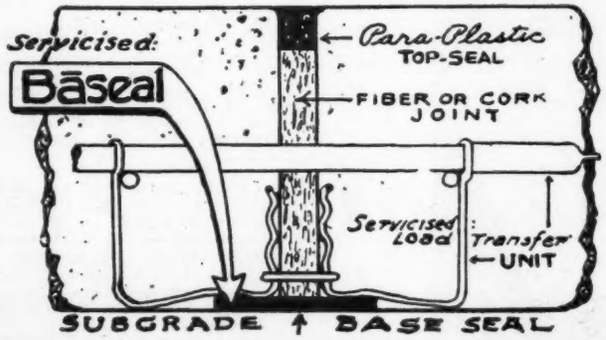
Baseal has this outstanding quality that after the wet concrete is poured on, sets up and becomes dry, a permanent bond is formed with the BASEAL, which results in a perfect watertight joint between the two adjoining slabs and the base strip.



TIME AND LABOR SAVED

Baseal is a pliable adhesive strip of one quarter inch thickness, and of width (usually 3 to 8 inches) and lengths to conform to width of paving slab. A very important feature of Baseal is its high degree of cohesive, adhesive, resilient and permanent plastic properties. It is easily handled, and installed. Supplied in convenient roll form, each strip is treated to prevent pieces from sticking together in shipment or storage.

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Designed for all leading makes of tractors. Can be quickly mounted or dismounted. Special dust-catching hood helps keep tractor and operator clean. Hood can be quickly removed for sweeping snow. Operates from tractor seat. Long-wearing, economical Palmyra fibre brush. Long-life, all steel construction. Gears run in bath of oil . . . positive zerk lubrication at all bearings. Furnished in brush lengths of 5, 6, 7, 8, and 9 feet.

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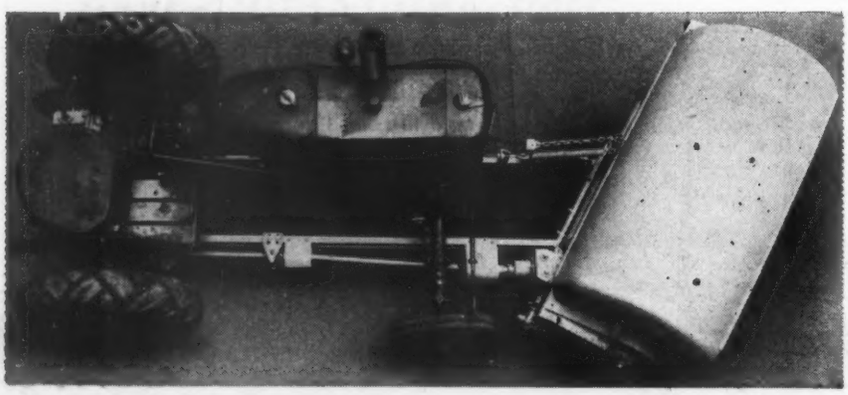
View from above of LITTLE GIANT TRACTOR SWEEPER



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Highways. By L. F. Johnson. Pp. 86-88.

16. The Highway Contract Situation. By C. M. Hathaway. Pp. 89-90.

J *American City*
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9. Worcester Builds an Airport Without Federal Aid. By George E. Comstock. Pp. 87-88.

K *Proceedings, American Soc. of Civil Engineers*
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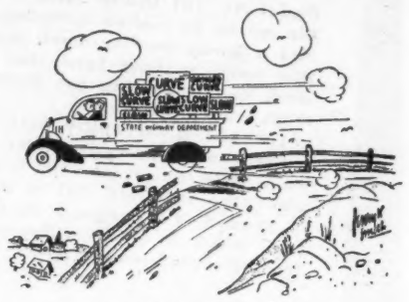
1. Express Highway Planning in Metropolitan Areas. By Joseph Barnett. Pp. 287-305.



"I think we had better put one there, Bill!"
Courtesy Highway Magazine

L *Civil Engineering*
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2. Round-the-Clock Job for the Task Force. By W. G. Staggs and J. H. Dudley. Pp. 120-121.
3. Wind Analysis for Airport Design. By Samuel B. Solot. Pp. 122-124.

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4. What Can Be Done About Traffic Congestion. By Leslie Williams. Pp. 149-151.
5. Urban Parkways and Expressways. By W. S. Chapin. Pp. 151-153.

N *Roads and Streets*
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24. Stockpiling 85,000 Tons of Stone Ballast. Pp. 82-83.
25. Soil-Cement Streets for Subdivisions. By D. A. Loftus. Pp. 84-85.

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17. A Simplified Rock Classification for Highway Engineers. By D. G. Runner. Pp. 23-24, 32.
18. Radio Coordinates Highway Work. By W. Bruce Chilson. Pp. 29-31.

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3. Tractor Scraper on Highway and Ditch Work. Pp. 96-97, 148.

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10. Soil Stabilization. By Robert L. James. Pp. 515-517.

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12. Uses and Abuses of Bitumen in Road Construction. By A. W. Jarman. Pp. 591, 593, 595.

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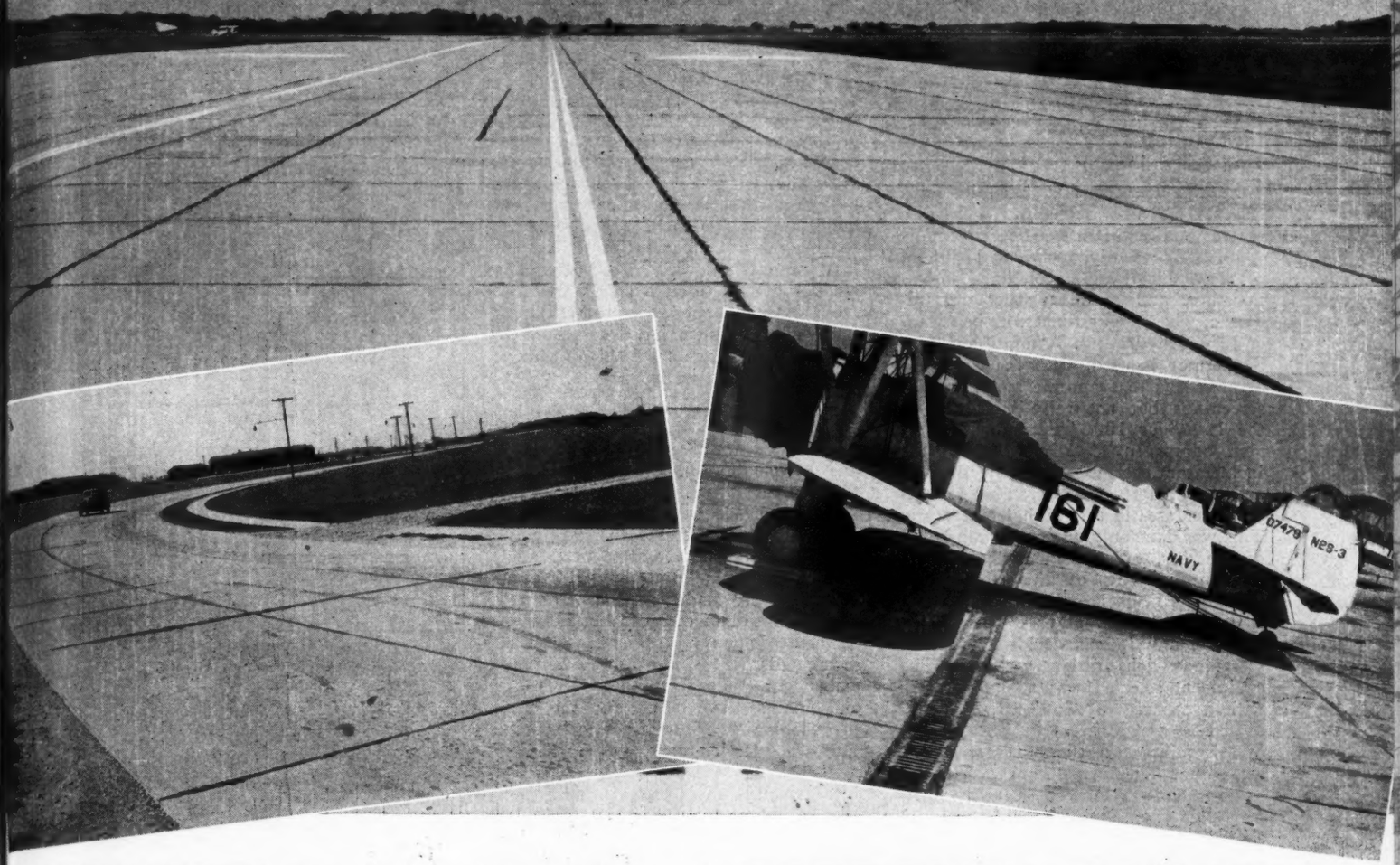
7. An Aerodrome Analysis: Part V. By J. V. Hewes. Pp. 1-3.
8. Mechanical Equipment. By R. Gordon Hughes. Pp. 7-8.

"THREE SEVERE WINTERS *plus* DE-ICING TREATMENTS LEFT NO MARKED EFFECT..." *

*Engineering News Record — Feb. 21, 1946 Pgs. 80-81
"Durability of Concrete at an Airfield."



240,000 Cubic Yards of POZZOLITH CONCRETE In U. S. Navy Bunker Hill Air Station

"Alternate freezing and thawing during the past three winters has caused no noticeable deterioration . . . nor has the application of calcium and sodium chlorides which were used extensively on portions of the pavement.

"Credit for this durability . . . is attributed to the use of a cement dispersing agent . . ." (Pozzolith). Cement dispersion also served importantly as a lubricating agent to provide a properly lubricated, plastic mix.

Pozzolith produces all the benefits of air entrainment and does so with increased strength and at lower cost. Findings of the Nation's top testing authority prove this. Pozzolith's high standard of performance has won it wide acceptance as use in millions of cubic yards of concrete testify.

May we have one of our field representatives call, by appointment, to provide you with further information on the benefits of Pozzolith, cement dispersion?

THE MASTER BUILDERS COMPANY

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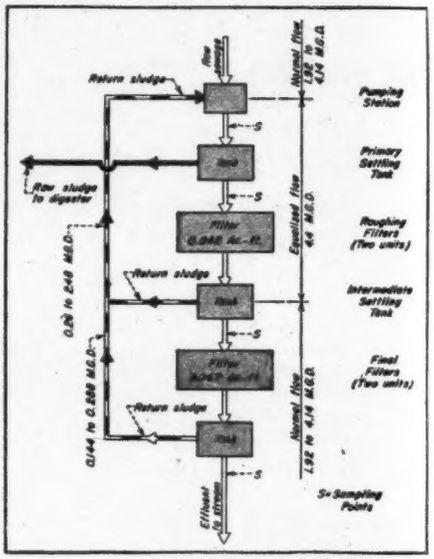
The Sewerage Digest

Incinerating Fine Screenings

Sewage treatment at Niagara Falls consists of fine screening with disc screens and chlorination. The screenings were, until recently, incinerated without previous dehydration, containing 85% moisture, and auxiliary fuel was required, which was estimated to be cheaper than dehydrating. A multiple-hearth incinerator is used, with the drafts so arranged as to evaporate and burn the screenings but not raise the gases to the 1600° or 1800° necessary to prevent odors. In 1942 odors from the incinerator became very objectionable and the drafts were rearranged to subject the gases to this high temperature. This was done only during certain hours of the day, to save in fuel; but this constant varying of the temperature caused the brick hearths to expand and contract and show signs of permanent damage, and it was decided to install screenings dehydration facilities. The equipment selected was a sludge press with a capacity of 2600 lb. of dehydrated sludge per hour, of a type used at Milwaukee for several years. At the same time the incinerator was rebuilt so as to omit three evaporating hearths, an automatic feeding device was installed to maintain a uniform low rate of fuel to the furnace, and other changes made. Originally hot gases from the burning hearths passed over the evaporating hearths and were not again reheated sufficiently to destroy the odors. Now the hot gases do no evaporating but pass direct through a waste heat boiler and to the stack. The dehydrator reduces the water content of the screenings from about 85% to 60%. The amount of fuel used has been reduced from 2.86 tons per day to 2.25 tons. "The odor problem has been solved in a highly satisfactory fashion without increasing operation expenses." C16

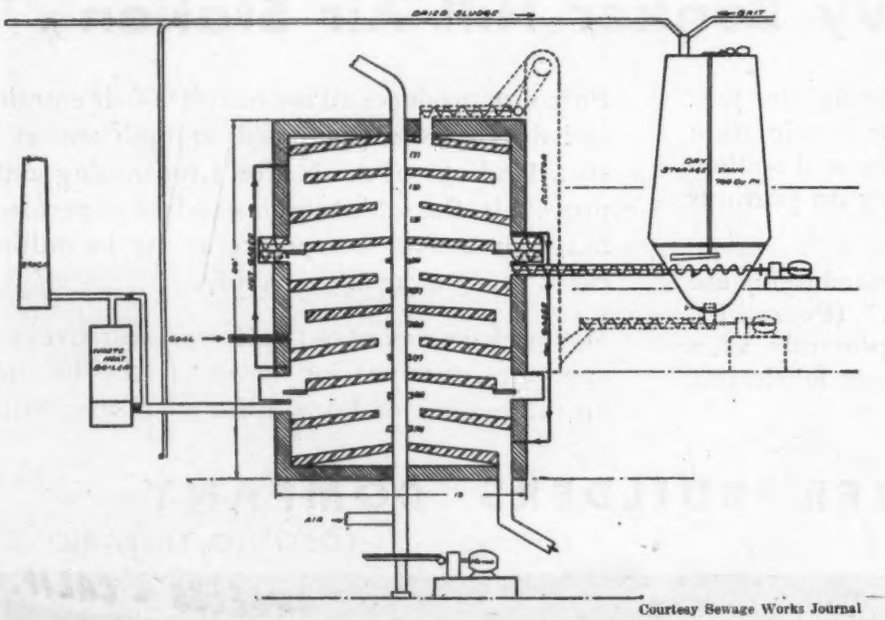
Overloading Two-Stage Filters

A two-stage fixed-nozzle trickling filter plant was built for Fort Sill, Okla., in 1941, designed to treat 1.82 mgd. Wartime increase in 1944 gave an average of 2.80 mgd to be treated, with a maximum rate of 4.14 mgd. Changes were made and the plant now handles this amount, operating as shown on the accompanying diagram. Screened sewage discharges into a wet well, together with sludge from the intermediate and final settling tanks, and this mixture is pumped by two identical pumps into the grit chamber, from which it flows through the rest of the plant by gravity. The raw sewage flow varies from 1.92 to 4.14 mgd, and sludge from the final settling tank from 0.144 to 0.288 mgd. The pumps are adjusted to draw from the well at the uniform rate of 4.4 mgd (slightly over the actual maximum sewage flow), and sufficient sludge enters the well from the intermediate tank to maintain this rate; this being effected by a valve on the end of the sludge line from the intermediate tank, which is operated automatically by the water level in the wet well. The B. O. D. removal by this plant while treating more than 150% of its design capacity has averaged 91.5%, with a minimum of 88.2%. It is believed that this high efficiency is due to this equalization of flow through the primary settling tank and roughing filters. Operation of the pumps under a constant head minimizes cost of operation. It is believed that none of the current process patents are infringed by this plant. E1



Courtesy Engineering News-Record

Flow recirculation at Ft. Sill.



Courtesy Sewage Works Journal

Niagara Falls screenings dewatering and incineration process.

Paint in Sewage Plants

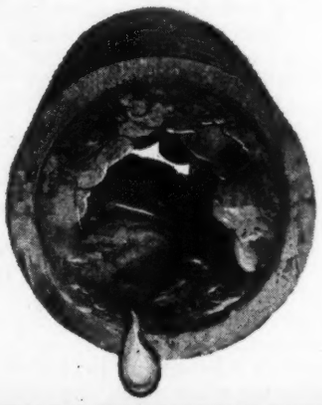
The cost of paint is but 20% to 25% of that of a painting job, so five times as much can be paid for a good paint as for one that will last only half as long. But no paint can give its best if the painting is done over a dirty or damp base, and avoiding this is difficult.

All paints soften under the greasy scums which attach themselves to anything at the surface of sewage. Brushing the scum off abrades the softened paint, but if it is not removed it rots it rapidly. The best solution seems to be the thickest possible coat of pure tar or asphalt.

$2,000. INVESTMENT PAYS $29,565. PROFIT on a Flexible pipe cleaning job

WHAT WILL IT BE?

A Trickle or a Torrent for new Homes in your city?



THE above figures are the actual investment and profit from a Flexible watermain cleaning job in one city.* The lines were cleaned in 1940 for a total cost of $2,000. During the past five years a constant ph has been maintained. Actual savings in pumping costs amounted to $18,250 over the five-year period. With an increase of 365,000,000 gallons of water pumped each year or 1,825,000,000,000 gallons total at 3½¢ per cu. ft., the profit was increased $13,565 or a grand total of $31,565 less the $2,000 original investment.

Would your city be interested in an investment that pays 1400 per cent? Let Flexible figure the cost of cleaning your mains. Write or wire today for details.

*Name of city furnished upon request.

Flexible Service trucks complete with experienced crews and special Flexible-developed tools are strategically located in all sections of the U.S.A. to give pipe cleaning service quickly.

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When you need special information—consult the classified READER'S SERVICE DEPT., *pages 71-73*

Cast iron has a deservedly high reputation for resisting corrosion, but mild steel proves very susceptible. Good quality galvanizing after fabrication gives substantial protection but is not practicable for large parts and, once the galvanizing has been pierced, the corrosion is accelerated by electrolytic action. "Parkerising" has been suggested as a possible solution but the author knows of no experience with it in sewage plants.[Y3]

Aerating Polluted Rivers

After two years of full-scale experimenting on a stretch of the Flambeau river in Wisconsin under the direction of the National Council for Stream Improvement, the conclusion was reached that mechanical reaction of streams may be considered a practicable method of reducing pollution at less cost than treatment of waste liquors prior to their discharge. It is limited, however, to use in streams whose dissolved oxygen content is below about 4 ppm. Where pollution is due to sulphite waste liquor, the process is efficient only if the minimum B. O. D. loading lies between 1,000 and 5,000 lb. per 100 cfs of stream flow. The principal advantage lies in decreasing the length of stream involved in the active stage of microbiological oxidation and in maintaining dissolved oxygen levels above a safe minimum for the requirements of normal stream life. In the experiment, a compressor furnished 1550 cu. ft. per min. of air at a pressure of 5 to 6.5 psi, through both plate-type and tube-type diffusers.[E3]

Control of Chlorination Of Los Angeles Sewage

The beaches of Santa Monica Bay, Calif., are so polluted with the sewage of Los Angeles that they have been quarantined until the bacterial contamination has been reduced at least 50%. Jar tests indicated that less than an average of 20 ppm of chlorine would completely disinfect the sewage in 10 minutes contact time. A pilot plant was built to chlorinate 0.1% of the sewage (160,000 gpd), which was operated to establish the doses of chlorine needed, and demonstrated beyond doubt the feasibility and chlorine requirements of the disinfection and the certainty of the results by use of orthotolidine tests. The chlorine required would range from an average rate of 5 tons a day around 10 A.M. to 24 tons around 3 P.M. The heart of the operation is the test for residual chlorine; if any remained after 6 min. of contact, the E. Coli disinfection was assured. Samples of chlorinated sewage were taken at intervals of 15 min. during the day and 30 min. at night, and the chlorine dosage regulated accordingly. Not more than two minutes need elapse between a critically low feed of chlorine and its adjustment. An operating setup would consist of the necessary manually-operated chlorinators with weighing scales and ton or car cylinders; also, a pilot plant such as used in this investigation, except that the sewage flow can be kept constant to determine the required chlorine dose several times an hour, as a guide to the setting of the chlorine machine. The operation comes down to determining a chlorine dose that maintains a trace of residual chlorine after five or six minutes' contact time.[H24]

Certification of Operators in Michigan

Michigan has the voluntary certification plan for sewage plant operators, a board of examiners issuing certificates, and revoking them for deception in the examination or negligence in discharge of duty. The examinations are divided into four major sections: 1. The educational qualifications of the applicant. 2. His experience qualifications. 3. His personal characteristics. 4. His technical knowledge on the general subject of sewage treatment plant operation. Plants are divided into 4 groups—serving populations of 40,000 or over; 40,000 to 10,000; 10,000 to 2,000; less than 2,000; and operators are certified accordingly, but no certificates are issued for the lowest class. The examination consists of 50 "true or false" questions; 25 requiring filling blanks with a few words; and questions of the problem and essay type. Evaluation of his personality and character is the least satis-

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The coupon method of internal inspection is only one of the steps in the Stacey Brothers Gas Holder Inspection Service. Based on scientific survey, thorough examination, laboratory tests and engineering study, we'll give you a comprehensive report and specific recommendations to help you insure maximum life for your holder.

Now's the time to let us give you this personalized annual inspection service. Many prominent operators already have entered their contracts with us for the 1946 season . . . and we've served some of them year after year. Their contract renewals are your best assurance of our ability to give you prompt, economical and efficient inspection. May we discuss your requirements with you?

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One of the Dresser Industries
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Coupons are cut with a special disc-cutter like this. An Archimedean screw holds the cutter in position, clamps the rubber sealing base ring tight against the holder shell, and prevents the coupon from falling into the holder after it is cut.

This and many other features of Stacey Brothers Gas Holder Inspection Service are described in a 16-page illustrated catalog, number I-44 Write us for your copy.

Stacey Brothers TANKS

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CHEMICAL USERS' GUIDE To General Chemical Company Products for Treatment of Water, Sewage, and Industrial Wastes

PRODUCT	AVAILABLE FORMS	COMMERCIAL STRENGTH (MIN.)	SHIPPING CONTAINERS	APPLICATIONS
Aluminum Sulfate $Al_2(SO_4)_3 \cdot 14H_2O$ approx. *(Filter Alum)*	Commercial & Iron Free: Lump • Ground Powdered	17.25% Al_2O_3	Bags Barrels • Drums Bulk Carloads	Coagulant for water and sewage. Dewatering conditioner for sewage sludge. 1% Sol. pH 3.4.
Aqua Ammonia NH_4OH plus Water *(Ammonia Water)*	Colorless Liquid	26°Be. (29.4% NH_3)	Steel Drums Carboys	Used with chlorine to form chloramines for water and main disinfection.
Ammonium Aluminum Sulfate $Al_2(SO_4)_3 \cdot (NH_4)_2SO_4 \cdot 24H_2O$ *(Ammonia Alum) (Crystal Alum)*	Lump Nut Granular Powdered	11.2% Al_2O_3	Bags Fibre Drums	Coagulant for water. Advantageous for pressure filters. Supplies ammonia for chloramine formation. 1% Sol. pH 3.5.
Sodium Bisulfite, Anhydrous $Na_2S_2O_5$ *(ABS) (Sodium Metabisulfite)*	Powdered	97.5% $Na_2S_2O_5$ (Equiv. 65.5% SO_2)	Fibre Drums	Antichlor. Remove iron and manganese deposits from filter sand. 1% Sol. pH 4.6.
Sodium Silicate $Na_2O \cdot X(SiO_2)$ plus H_2O *(Water Glass) (Silicate of Soda)*	Viscous Liquid	38° to 52°Be. Various Ratios of $Na_2O \cdot SiO_2$	Drums Tank Cars Tank Trucks	1. Aid in floc formation. 2. Prevent red water in distribution lines. 1% Sol. pH 12.7.
Sodium Thiosulfate $Na_2S_2O_3 \cdot 5H_2O$ *(Hypo) (Sodium Hyposulfite)*	Crystals: Prismatic Rice Selected Universal Granular	99.75% $Na_2S_2O_3 \cdot 5H_2O$	Bags Barrels Fibre Drums	Antichlor. Water solution is neutral.
Sulfuric Acid H_2SO_4 plus H_2O *(Oil of Vitriol)*	Corrosive, oily liquid Various strengths	66°Be. (93.19% H_2SO_4)	Bottles Carboys Drums Tank Trucks Tank Cars	1. Reduce pH and alkalinity. 2. Regenerate carbaceous zeolites and ion exchangers.
Potassium Aluminum Sulfate $Al_2(SO_4)_3 \cdot K_2SO_4 \cdot 24H_2O$ *(Potash Alum)*	Lump Nut Granular Powdered	10.7% Al_2O_3	Bags Fibre Drums	Coagulant for water. Slow, even rate of solubility desirable for solution pots. 1% Sol. pH 3.52.
Sodium Sulfite, Anhydrous Na_2SO_3 *("Sulfite")*	Granular Powdered	98.5% Na_2SO_3	Bags Fibre Drums	Weak solutions absorb oxygen readily. 1% Sol. pH 9.8.
Sodium Sulfate, Crystal $Na_2SO_4 \cdot 10H_2O$ *(Glauber's Salt)*	Crystal & Needle Cryst.	96% $Na_2SO_4 \cdot 10H_2O$	Barrels Bags Drums	Neutral Solution.
Sodium Sulfate, Anhydrous Na_2SO_4	Powdered	99.5% Na_2SO_4	Bags Barrels	Neutral Solution.
Trisodium Phosphate $Na_3PO_4 \cdot 12H_2O$ *(TSP)*	Crystal	98.5—103% $Na_3PO_4 \cdot 12H_2O$ (Equiv. 19% P_2O_5)	Bags Barrels Fibre Drums	Boiler water treatment. Cleaning compound. 1% Sol. pH 11.8-12.0.
Disodium Phosphate, Crystal $Na_2HPO_4 \cdot 12H_2O$	Crystal	98% $Na_2HPO_4 \cdot 12H_2O$ (Equiv. 19.5% P_2O_5)	Bags Barrels Fibre Drums	Boiler water. (Calcium and magnesium precipitation.) 1% Sol. pH 8.4.
Disodium Phosphate, Anhydrous Na_2HPO_4	Powdered Flake	96% Na_2HPO_4 (Equiv. 48% P_2O_5)	Same	Same as Crystal, but stronger product.
Tetrasodium Pyrophosphate, Anhydrous $Na_4P_2O_7$ *(TSPP) (Pyro)*	Powdered	98% $Na_4P_2O_7$ (Equiv. 52% $5P_2O_5$)	Bags Barrels Fibre Drums	Stabilization of water. Used for P_2O_5 content in boiler waters. 1% Sol. pH 10.1.
Sodium Fluoride NaF *(Fluoride)*	Powdered (white or blue colored: Nile Blue) Light or dense	90% and 95% NaF	Bags Barrels Fibre Drums	Fluorination of water supplies. (For information, consult with local and state health officials.)

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factory, but integrity, loyalty, resourcefulness, perseverance, diplomacy, energy and thought habits are more important than information or understanding of the art. Effort has been directed chiefly toward certifying the superintendent or person in actual operating charge of a plant, which practice is open to criticism in large plants where foremen or assistant superintendents have considerable responsibility. Another debatable procedure is licensing by plant classes; possibly certifying to specific plants would be better, but more difficult to administer.[C18]

Rats in Sewers

Many of the sewers in Glasgow, Scotland, are more than 100 years old, much larger than needed, and deposits form in them continuously. They are infested with rats, and it is believed that these infect the men cleaning the sewers with Well's disease (the first symptoms of which are those typical of influenza), which has proved fatal to at least one worker. Effort is being made to exterminate the rats. In the six months following August, 1945, 21,000 rats were killed. Trays are fastened to the walls of manholes, with pieces of rope hanging from them up which the rats can climb. Sausage rusk, as bait, is placed in them for four successive days, and on the fifth day arsenic is mixed with the rusk. Following this, unpoisoned bait is used again. The number of rats poisoned is based on a comparison of the amount of bait eaten before and after the poisoning, it being "known that each rat eats about 1 oz. of food per day." The cost to date has been about $5,000.[D15]

DDT for Filter Fly Control

Experiments in the use of DDT for controlling filter flies and larvae in trickling filters have been conducted independently at a Texas Army camp and at an Atlanta, Georgia, treatment plant. In both cases the conclusion was reached that DDT treatment is most effective when directed at the larvae, the chemical being applied with the sewage flow. Control of flies in the adult stage by application of DDT to contact surface was found to be incomplete. The cost, based on present prices and the rates proposed, would be about $36 per mgd for a treatment that would remain effective for about 15 days.

DDT is not soluble in water, and it was proposed to apply it as an emulsion of 20% DDT dissolved in 60% Xylene, with 20% Triton X-100 as the emulsifying agent, diluted with water to give not more than 5% DDT. This is applied to the influent headbox of a filter and no more sewage admitted to that filter for an hour, during which the DDT trickles slowly through the filter. The amount recommended is 1 ppm of the total daily flow of sewage; as applied, the concentration may be 100 times as great. No damage was caused to the filter growth; DDT appears to be specific for insects and not a fungicide. Sewage filter bacteria are not killed by concentrations up to 100 ppm.

If this treatment proves successful it will eliminate the necessity of so constructing filters as to provide for flooding, and of periodic reduction of filter efficiency occasioned by it.[C13, 14, 26]

Notes on Sludge Digestion

It is suggested that, instead of stating digester accomplishment in pounds of solids per cubic foot of digester capacity per month, pounds of *volatile* solids be used. Experience at Jackson, Mich., has been that not much more than 0.5 lb. of volatile solids can be digested per cubic foot per month at 85° F and produce a fair supernatant and sludge that will dewater satisfactorily. By multistage digestion, the primary stage being heated to thermophilic temperature, 1.6 times as much volatile solids may be digested as with mesophilic digestion, and a good filtering sludge be produced. However, thermophilic digestion requires about twice as much heat as that at 85° F and is more difficult to operate; a rapid change in

30 years of success and experience back up your judgment — when you select Le Roi Engines for public works. 4 to 400 hp.—2 to 12 cylinders. Dependable, economical power—utilizing low-cost sewage gas, natural gas, butane, or gasoline.

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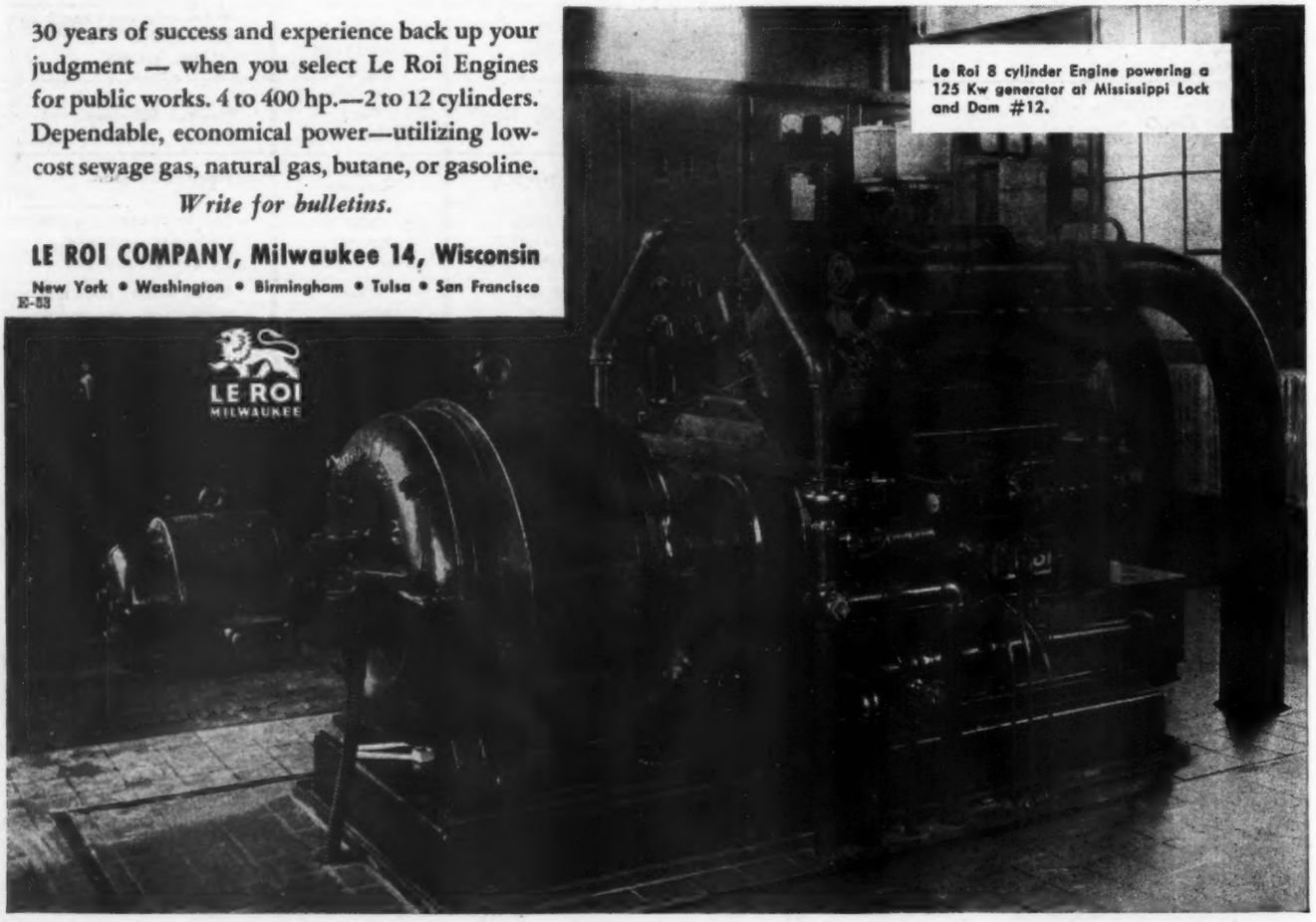

Le Roi 8 cylinder Engine powering a 125 Kw generator at Mississippi Lock and Dam #12.

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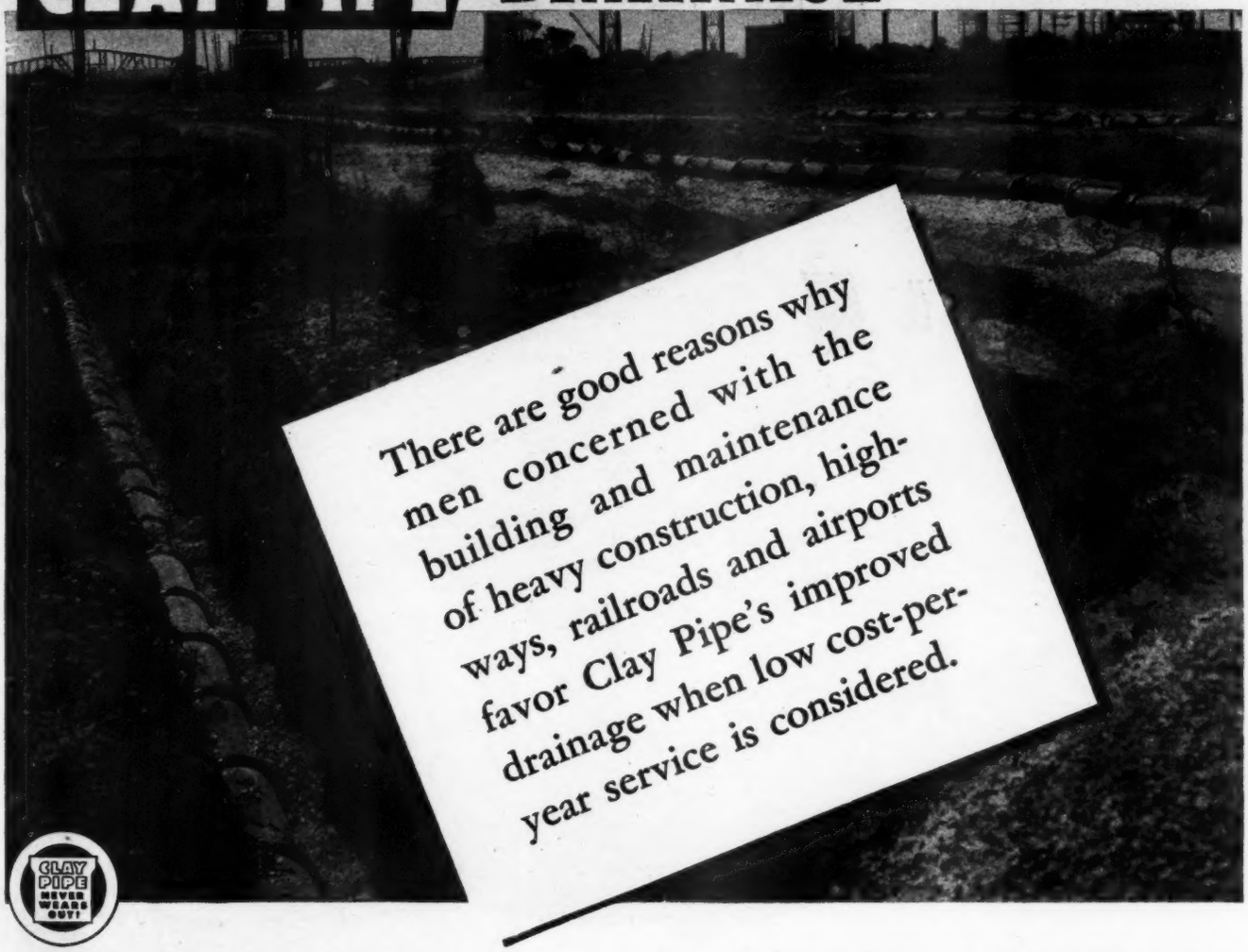
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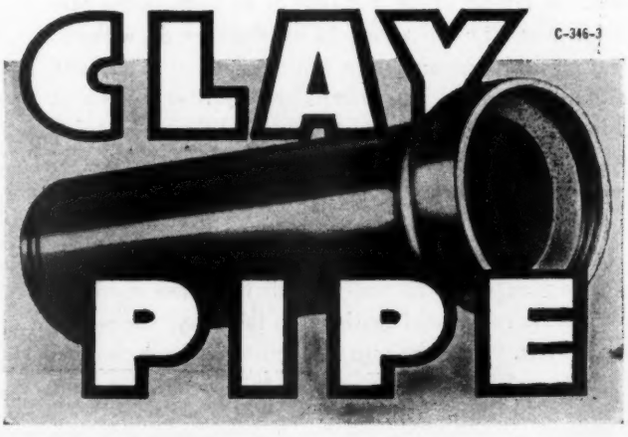

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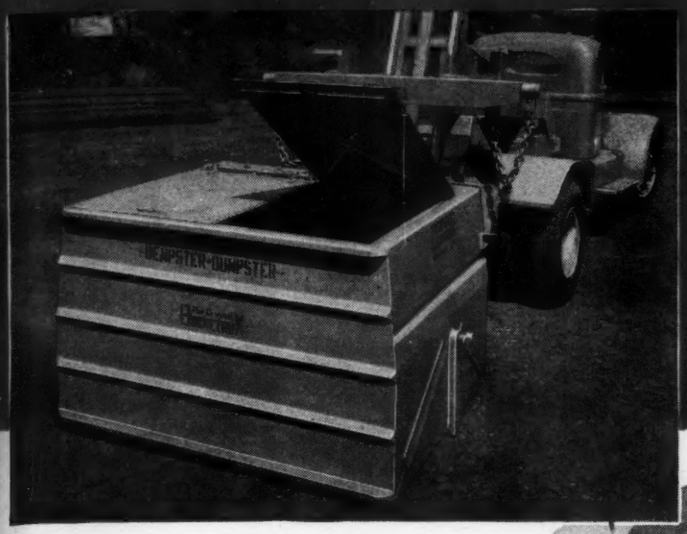
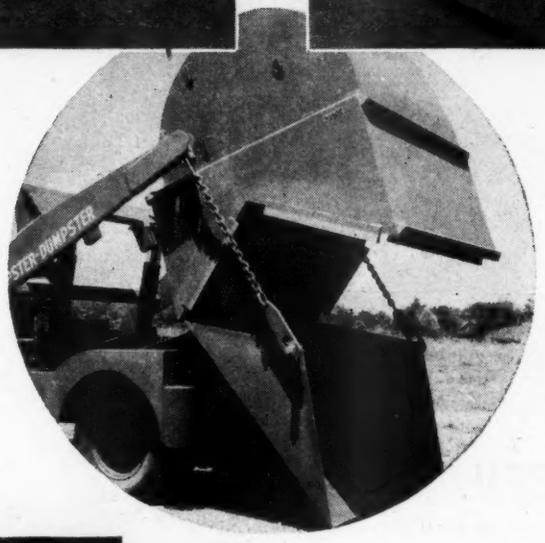


Note, on opposite page, truck equipped with Dempster-Dumpster Type "LFW" Hoisting Unit. This unit is never idle . . . always busy, hoisting, hauling and dumping previously loaded bodies of all types . . . a single truck serves numerous bodies, including the Dempster-Kolector for residential use.



Several types of bodies are provided to meet the requirements of Community Centers, Schools, Apartments, Congested business areas, Plants and Factories. Shown above, left, is a Flat Top Drop Bottom body; right, the Apartment Type body. Circle photo illustrates automatic, instant dumping action of drop bottom type bodies.

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temperature of 5° to 10° can completely upset the digestion process.[C15]

Garbage in Sewage at Marion, Ind.

It is found that ground garbage can be put in the sludge digestors more profitably by keeping it in a separate well and pumping it directly into the digesters. A ton of green ground garbage containing 260 lb. of volatile material produces 2600 cu. ft. of gas, worth $1.00 as fuel, and this sum is paid to the garbage department for garbage delivered at the plant.[C25]

Scum Reduction By Ammonium Sulfate

At Buffalo, N. Y., scum averaged 20% by weight. At times when the scum averaged 12 ft. in depth, quantities of ammonium sulfate containing 25% available ammonia were fed into the tank, causing a notable increase in tank activity and gas production and making the scum more readily withdrawable.[C25]

Uses of Chlorine

Chlorine is applied to sewage for disinfection, B. O. D. reduction, and control of odors and septicity. Also it is used for removing growths in trickling filters, and controlling filter flies. Application of it to return sludge in activated sludge plants sometimes has prevented bulking. In sludge thickening units it may assist settling. Prechlorination in conjunction with preaeration may aid in removing grease.[C23]

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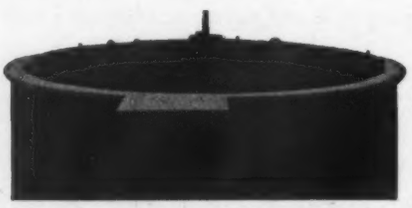

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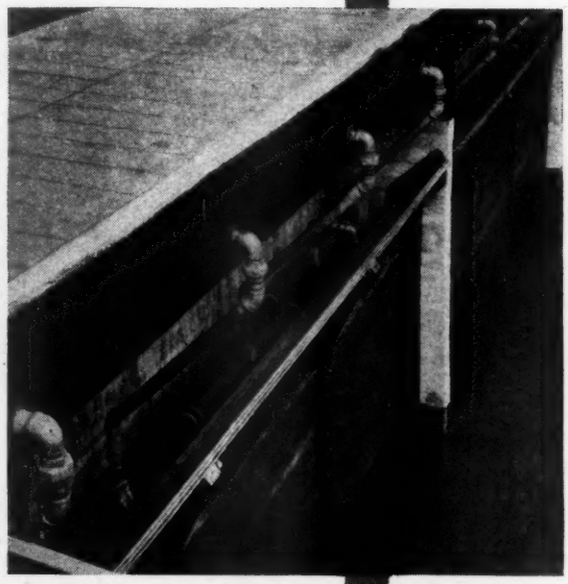

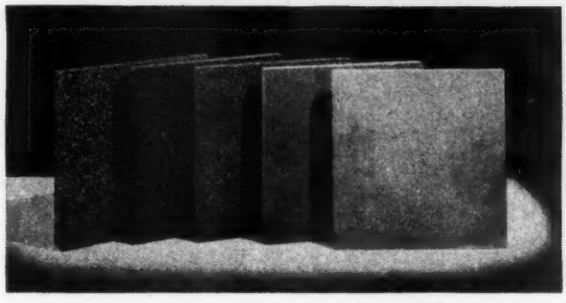

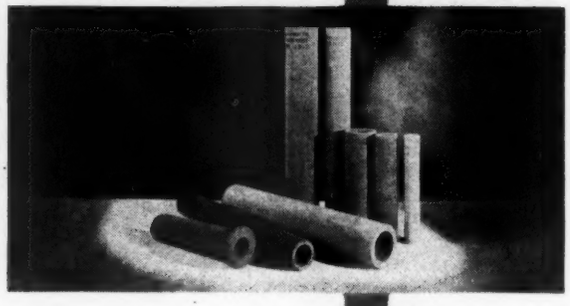

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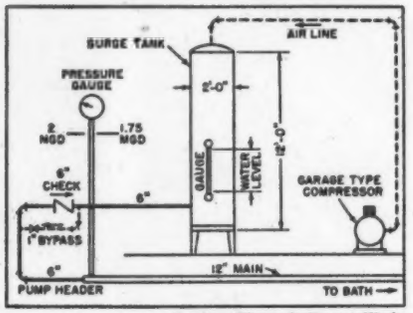
The Waterworks Digest

Surge Tank for Water Hammer

A plate fabricating plant at Bath, Me., drew water from a 12" dead end line through an 8" connection and several quick-acting valves, which created almost constant pressure fluctuations between 70 and 115 psi.

In June, 1942, a surge tank was installed in the pumping station, consisting of a galvanized steel tank, 3-8 in. thick, 24 in. in diameter and 12 feet high. A boiler gauge glass was mounted so that its middle point coincided with the quarter-full point of the tank.



Courtesy Water & Sewage Works

Pneumatic surge tank installation.

This tank was connected through 6 in. flanged pipe to the discharge manifold of the pumping station and a 6 in. swing check valve was installed just ahead of the tank.

This check is set so that water can flow into the tank and be prevented from flowing out, except through a 1 in. bypass around the check valves—(see sketch).

The water level in the surge tank is maintained at the quarter point by means of a garage type air compressor operated manually about once a week.

This installation has completely eliminated water hammer.[G17]

Vacuum Deaeration

Certain types of corrosion are due to the presence of dissolved gases in relatively cold water, the most common gases being dissolved oxygen and carbon dioxide. Removal of these gases will greatly reduce such corrosion. The first large-scale deaerator for water in this country was one built at Port Sulphur, La., 10 years ago to deaerate 4 mgd of water which had so corroded a steel pipe line as to reduce its capacity 22% in 129 days. After cleaning the pipe and deaerating, the capacity was restored to 95% of the original and has decreased very little since then. In this plant (see illustration) cold water is delivered to the top of the deaerator and distributed over perforated plates; then falls through a series of slat bundles to a storage reservoir. Sodium sulphite is injected into the effluent to chemically complete the removal of dissolved oxygen. The dissolved gases are removed by a vacuum line connected to the top of the deaerator, a vacuum of 28 to 28½ in. of mercury being maintained by a dry vacuum pump.

In designing a deaerating plant, it must be borne in mind that:

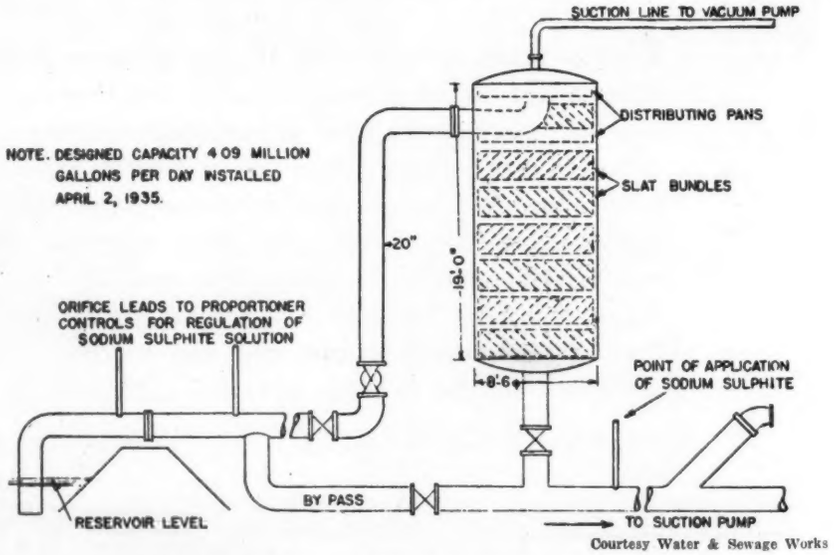
1. The flow rate of the liquid must be maintained sufficiently low in terms of gallons of water per square foot of cross section area to prevent flooding of the packing.
2. The depth of the packing must be such as to provide enough time for equilibrium to be reached or closely approximated.
3. The packing should be properly spaced to effect good distribution and so designed to prevent channeling.
4. Pipe lines of adequate size to remove the vapors with a minimum of pressure drop must be provided.

A multiple-stage vacuum deaerator possesses several advantages. The maintenance of a difference in pressure between stages reduces the expanded volume of gas that must be removed by the vacuum pumps, effecting a net saving in pump cost; and permits economical maintenance of a lower amount of residual gas in the deaerated effluent. Some have reduced cost and increased gas removal by operating with a vacuum of 25 + in. of mercury, followed by use of sodium sulphite. The cost of the equipment complete has been approximately $10,000 for a single-stage plant for 1,000 gpm, with about $3,000 for each additional 1,000 gpm.[G16]

Intake Construction

Waterworks intakes should furnish protection against wave action and floods, to insure permanency; against the action of ice to prevent stoppage and to exclude floating objects; against the ingress of sand, which may be destructive to pumps and valves; and against pollution, as far as possible, by choice of location of the intake and depth at which the water is taken.

On the Great Lakes, ice may form solid to the lake bottom for 500 to 1,000 ft. from shore; because of which and of the greater pollution near shore, the intakes are located in some cases 2 or 3 miles from shore. Chicago's cribs take water through several intake ports 5 to 12 ft. above the lake bed, the water then entering a well inside the crib which connects to a tunnel extending to the pumps. Where conditions are favorable, especially as to water depth, cribs entirely submerged are practicable, and are used by practically all the smaller cities on the Great Lakes. Where water is taken from rivers, difficulty may be caused by great variations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Courtesy Water & Sewage Works

Design for vacuum deaerating tank and tower.

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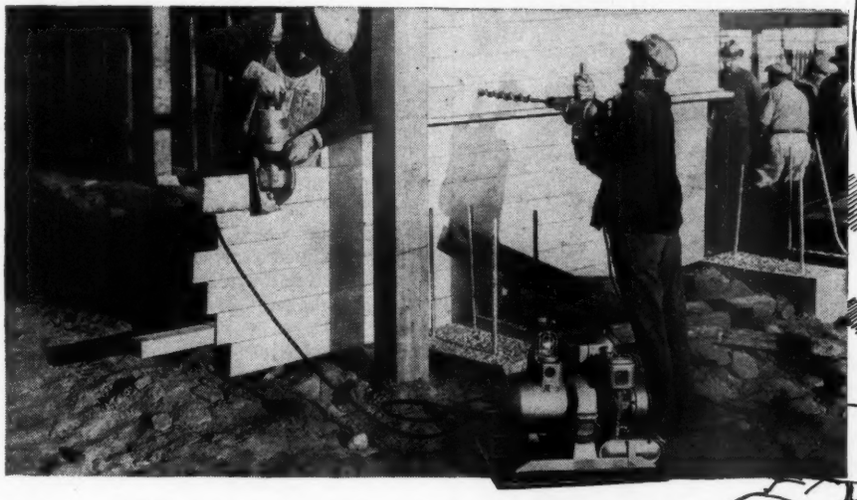

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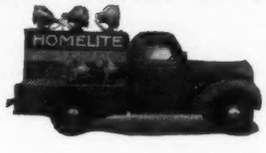

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in water depths, heavy drift, and character of the river bottom. Some river intakes provide ports at several elevations in towers similar to those used in impounding reservoirs. In some cases river intake must be kept low enough to prevent interference with navigation. Where the river has good velocity and reasonably permanent bottom, perforated horizontal pipes supported above the bottom may be used. Where the bottom is unstable it may be necessary to place the intake structure at or near the shore, with provision for minimizing the formation of mud banks in front of it. A few cities on rivers subject to great variations of level have placed both intakes and pumps on inclined tracks, moving them up and down as the river rises and falls. For excluding fish and floating objects, screens with ⅜ in. to 1 in. mesh are used. Traveling screens are coming into common use, especially in the larger plants.[A40]

Investigation of Reservoir Sites

In investigating a proposed site for a reservoir embankment or dam, detailed information should be obtained on the type of material overlying the contour of the rock surface, the permeability of the rock and the drift, courses of underground streams and other seepage, and materials available for making embankments. The first two are obtained by test wells and boreholes. The testing of the rock for leakage is generally done in descending stages of 20 ft. to relate leakage to the various strata. The water test pressures generally used are 90 lb. per sq. inch for the first 20 ft. stage and up to 150 lb. per sq. inch for subsequent stages maintained for 10 minutes. Lugeon (Barrages et Geology) states that for dams less than 30 m. high a leakage of 3 litres/per lineal metre per minute is permissible (0.21 galls./per 1 ft./min.), and for dams greater than 30 metres high 1 litre per lineal metre per minute.

The procedure adopted is to drill a hole about 25 ft. deep and fix a temporary concrete plug in the hole at the top of the 20 ft. to be tested, a 1-in. pipe, well greased, being in the centre of the plug. A water test is then carried out. If leakage is detected, the hole is grouted with rich grout (1 bag to 6 gallons). The 1-in. pipe is withdrawn before the grout has set, the plug drilled out, and the hole sunk another 20 ft. Another plug is then concreted in the same place as before, and the second stage of the hole tested. As the first 20 ft. has been grouted it is assumed that any leakage measured is confined to the second 20 ft. stage.

A similar method of water testing has also been used during the grouting of dam and other rock foundations during construction.

The discharges and temperatures of all springs and marshy spots immediately below the dam site or in adjoining minor catchment areas, and of streams in such areas, below the proposed reservoir level should be recorded at intervals before the reservoir is filled, and continued afterward; comparison of the before and after records may testify as to leakage.[D7]

Geophysical Prospecting for Water

Three methods of geophysical prospecting—the magnetic, the seismic and the resistivity—have been applied to problems of interest to the water engineer. The resistivity method depends on the electrical resistivity of the rocks involved, i.e., the resistance of a specimen of unit cross-section and unit length with the current flowing parellel to the length, measured in ohm-cm, ohm-ft., etc. The resistivity depends on (a) the amount of water present and (b) the salinity of the water, and may vary from 100 ohm-cm to several millions. It is possible to locate water directly by resistivity effects or indirectly by the location of geological structures favorable for its accumulation; also to examine foundations for the construction of reservoirs, dams, etc. During the campaigns in North Africa, geophysical methods of this nature were employed for water location. In the construction of an underground duct for Los Angeles a resistivity survey revealed the

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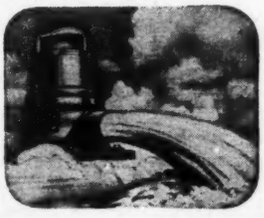

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position and extent of a shattered zone in the granite bed rock. An adverse condition is the existence of a good conducting layer at the surface; such a layer anywhere in the overburden will mask the influence of the underlying rocks.[Y7]

Macon's New Waterworks Headquarters

Macon, Ga., has completed, at a cost of $85,000, a water maintenance building which it considers to be one of the most modern in the south; complete, convenient and efficient, with room for expansion, located on a roomy, centrally located lot. Cleanliness is made posssible by composition tile and concrete floors. Quietness results from the ceiling of sound-proof board. Daylight brightness is due to an unusual number of large windows and glass panels between the offices, and fluorescent lighting is provided. There are offices, fireproof record rooms, stock rooms, a workers' shower and locker room, and a recreation room. Considerable thought was given to the comfort of the employes. There is also a meter repair shop, machine shop, and tool and storage rooms; a garage building with a wash pit and service station. The maintenance and operating work requires 30 employes, of which 16 are employed in the office, meter shop, auto repair shop, hydrant and valve shop, and on other headquarters work.[F26]

1945 Cost of 36-Inch Pipe

In August, 1945, Roanoke, Va., received bids for 35,000 ft. of 36" pipe, alternate bids being received for four kinds of pipe. The bids received were:

Steel cylinder reinforced concrete	$378,411
Steel pipe with bituminous spun lining and bituminous coated and wrapped exterior	420,694
Same as above without wrapping	377,523
Cement-lined cast iron	450,811

The contract was awarded for reinforced concrete.[A55]

Waterworks Employees Share in Profits

Last year the Waukesha, Wis., municipal water utility inaugurated an employees profit sharing plan, approved by the State Public Service Commission. This provides that the employees share in the net income on the basis of 4%, but no share shall exceed $200 a year; the latter provision, limiting the share of the higher-salaried employees, results in 3.6% for the higher salaries to 8% for the low-paid employees. It is believed that this will result in better employee-manager relationships.[A50]

Diversion of Waterworks Earnings

The practice of diversion of earnings to general municipal use prevails throughout New York State. This "restricts proper management of the waterworks organization. It fails to provide proper and necessary reserve funds for future extensions and maintenance work, it fails to provide incentive for efficient and intelligent operation and it is a terrific obstacle to intelligent long-term planning and management. The failure of political governing bodies to appreciate the inherent value to the community of a well-operated and maintained water supply and distribution system often results in a reduction in value of this asset."

Plants representing 60% of the municipally operated territories of the state report that operation by a separate board is suitable and satisfactory in 100% of the plants; but without a separate board this is considered true by only 60% of the villages and 50% of the cities.[A51]

Cleaning Western Pennsylvania Streams

Discussing the pollution of streams in Western Pennsylvania and measures proposed for controlling it, the author said: "The cleanup program should be carried out primarily to improve the streams from the water supply standpoint, endeavoring to complete first those parts of the program benefiting the largest number of the public, or

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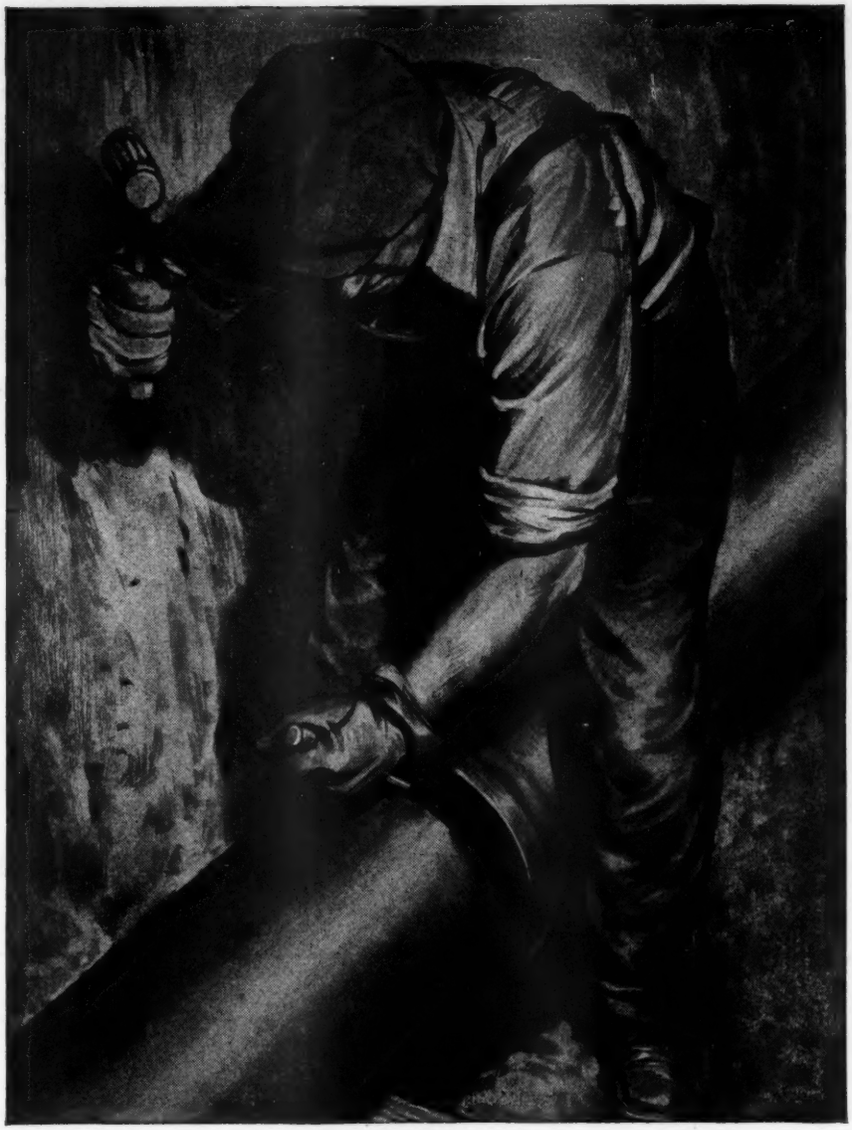

A well-calked joint—a level trench without humps or hollows—a tamped backfill in all but sandy soils: these are simple fundamentals of good practise in laying cast iron pipe. Observe them and you give the pipe full opportunity to deliver the centuries of useful life built into it at the foundry. For, cast iron pipe, like all materials of construction, must be properly installed if it is to give maximum service with minimum maintenance cost. Our new 16 mm. sound motion picture, "Installing Cast Iron Pipe" is available, on loan, without charge, to water and sewage works officials, engineering schools and organizations. Address Dept. F. Cast Iron Pipe Research Association, T. F. Wolfe, Engineer, 122 S. Michigan Ave., Chicago 3.

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those parts of the streams where the greatest difficulty is experienced in producing safe and satisfactory public water supplies. A suggested order of importance is: (1) adequate treatment of sewage, (2) better controls over the discharge of taste- and odor-producing waters, (3) better controls over the discharge of industrial wastes causing water treatment difficulties, (4) mine sealing, (5) flow augmentation with emphasis on those reservoirs best fitting into the pollution control program, and (6) the treatment of other industrial wastes. Certain of these activities should be carried out concurrently in order to secure the desired results. Federal funds should not be provided to construct works capable of materially modifying river flow conditions to the detriment of downstream water works unless such improvement is accompanied by parallel and adequate treatment of objectionable wastes discharged to the stretch of stream under consideration."[A58]

Postwar Water Rates

War expansion of industries caused great increases in the use of water, with resulting increase in income to water supply properties. With the shutting down of many of these industries, this income is decreasing rapidly and it is necessary either to increase rates or to encourage peace-time industries to make up the loss of the wartime industrial consumption. The latter would require making rates for industrial water more attractive, and the author suggests that in some cases this can be done by obtaining and distributing an entirely separate non-potable supply obtained at low cost, taking advantage of present low interest rates to construct the plant necessary for this. Illustrations of such a method are the industrial water supply for Birmingham, Ala.; the Dundee Water Power and Sand Co., in New Jersey; and the Panther Valley Water Co., which furnishes water to the Lehigh Coal & Navigation Co.[A59]

Corrosion Control With Sodium Hexametaphosphate

Reduction of corrosion of water mains by use of sodium hexametaphosphate was investigated at the purification plant of the Hackensack Water Co., using ¾" black steel pipe and a phosphate dose of 2 ppm. The water was a moderately aggressive one. It was found that the rate of flow through the pipe has a very important effect upon the results of the corrective or threshold treatment. Conclusions reported were:

The corrosion inhibiting effect of threshold treatment is materially affected by the type of corrosion product formed at the various rates of flow.

Threshold treatment does not prevent the actual removal of metal from the metal surface at any of the rates of flow employed in this study.

The rate of corrosion (removal of metal from the metal surface) and rate of tuberculation were found to increase with increasing rates of flow to some critical rate of flow, after which the corrosion rate decreased to a low value, and the rate of formation of the friction-causing components was materially reduced.

Under conditions of low rates of flow and up to and including some critical rate of flow, the rate of corrosion was found to be higher in the threshold treated lines than in those receiving no treatment; but the products of corrosion formed in conjunction with threshold treatment were more loosely adherent to the pipe wall than those formed with untreated water.

Threshold treatment showed a marked inhibiting effect in the rate of tuberculation.[A57]

Experience With Calgon

Bristol, Conn., population 35,000, has been treating its water supply for four years with sodium hexametaphosphate to minimize corrosion of the distribution system. Previously lime had been added to the filtered water to maintain a pH value of about 8.5. To prevent corrosion by the equilibrium method would require the use of such an amount

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of lime and soda ash as to materially increase the hardness and concentration of mineral matter. Calgon was applied at the rate of 2 ppm for the first two weeks, at the end of which the mains were flushed and extremely large amounts of tubercles and other corrosion products blown out. Since then the rate has been 1.5 ppm. In two months the Calgon was reaching the ends of the system and having effect on the iron concentration and color. The pH is uniformly 5.8 to 5.9. There has been no increase in corrosion of the pipes which could be attributed to the lowering of the pH. After the first two years of treatment the color at all points was uniformly low. To bring the Calgon to all dead ends, it is necessary to flush some of them occasionally.[G18]

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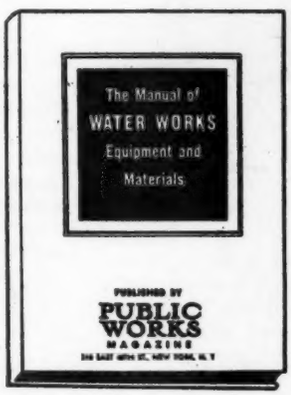

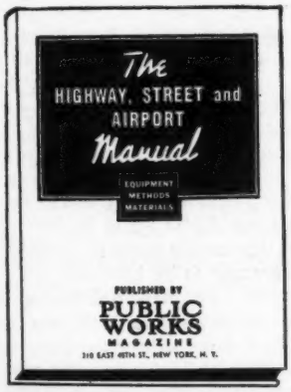

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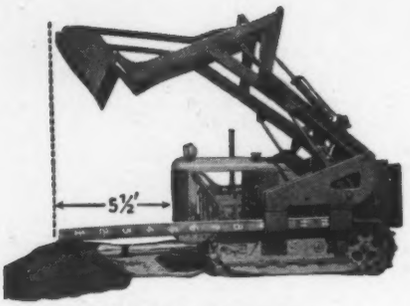


Drott high lift loader.

Drott Hi-Lift Loader

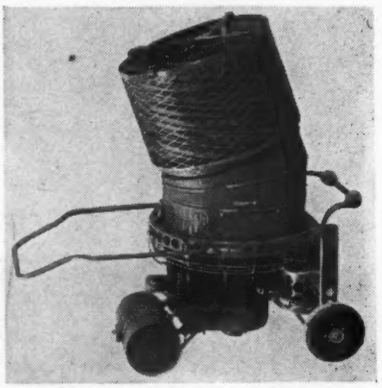
A new front-end tractor loader, the Drott Hi-Lift Loader, with extremely high lift and reach, is announced by Drott Manufacturing Corporation, Milwaukee 9, Wisc., formerly the Hi-Way Service Corporation. Designed for mounting on Oliver Cletrac crawler tractors, this loader has an unusual high lift of approximately 10' 8" and dumps its load about five feet ahead of the radiator, a definite advantage for loading trucks and other vehicles. The standard bucket has a capacity of 1¼ yards. A bucket of 1¾ yards is available for handling light materials.

The unit is hydraulically operated, and is controlled by the operator, either up or down, loaded or empty, by fingertip controls while the tractor is in motion or standing still. The load is not carried on the tractor but is semi-skidded to destination. When breaking out of a cut, the weight of the entire load is transferred to the shoes, which are making ground contact, and is not transported on the front end of the tractor. Full information may be obtained from Drott Manufacturing Corporation, 5141 North 35th Street, Milwaukee 9, Wisc.

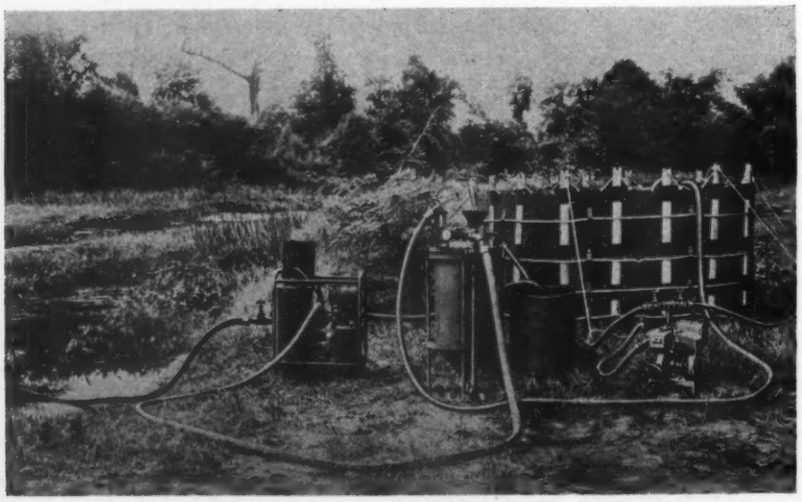
New Portable Ventilator

This new-type portable ventilator, made by the Herman Nelson Corp., Moline, Ill., consists of a high capacity fan powered by a light weight gasoline engine or electric motor, and 16 ft. of collapsible 14-inch air duct. Air delivery is up to 4500 c.f.m. Complete weight, mounted on a wheeled frame is only 87 pounds.

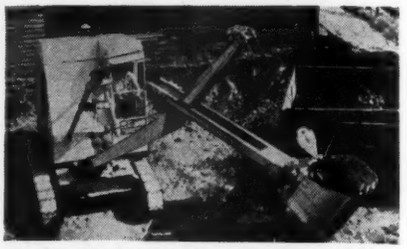
Every sewage treatment plant and every street and sewer department ought to have a ventilator to prevent danger of asphyxiation of gas poisoning from entering manholes, sumps and pits. Other city departments can find many uses for such ventilators; they are essential safety equipment.



Nelson portable ventilator.



Diatomite filter, pumps and canvas tank.



Byers junior excavator, with ⅜-yard dipper.

New Byers Junior Shovel

A light ⅜ yd. excavator, the "Junior," has been announced by the Byers Machine Company, Ravenna, Ohio. It weights not more than 8¾ tons complete, and is claimed to have unusual portability and mobility features of interest to smaller contractors, county engineers and township road supervisors who require excavating equipment that can move readily from one job to another.

A 37.5 hp industrial type motor provides power for hard digging. Excavator operator and all working machinery are located on the main frame and do not swing with the boom. Gears, clutches, drums and shafting are set low on the main frame, resulting in a low center of gravity. Fully enclosed cab, new dipper trip, worm and gear boom hoist, oversize clutches all of the same size with interchangeable linings and self-cleaning crawler treads are other features. For complete information and catalogs, write to the Byers Machine Company, Ravenna, Ohio.

Diatomite Water Purification Equipment

%Proportioneers% Pur-O-Pumpers, portable water treatment and filtration units, are designed for field use, can be carried to the job on a light truck. River or pond water is pumped by a gasoline engine-driven pump, treated by chlorine solution and filter aid and forced through a diatomaceous earth type filter capable of removing not only organic and inorganic suspended solids but also amoebic cysts and some bacteria. Water is immediately available in quantities from 4,000 up to 16,000 gallons a day depending upon the turbidity of original water to be handled.

Due to the complete utilization of area in diatomaceous earth filters and the ability of these filters to operate at a high rate (up to 25 gallons per square foot), these filters are much smaller than conventional sand filters of equal capacity and they are, therefore, ideally

suited to portable or semi-portable use. As the filtration is mechanical, the operator does not need to have a knowledge of chemistry. However, pretreatment of the water results in greatly increased filter runs.

These Pur-O-Pumpers, similar to the water purification units used so successfully by the Armed Forces during the war, should be very useful to construction crews, exploration parties and groups located far from a safe water supply. Further information may be obtained from %Proportioneers, Inc.%, 96 Codding Street, Providence, R. I.

The "Hatch Liner" and the "Slot Letter"

Two new time-saving drafting instruments have been made of the transparent acrylic plastic, Plexiglas, by the Dolgorukov Manufacturing Company of Washington. The "hatch-liner," used for doing rapid and uniform section lining consists of a 45° triangle and a small irregular octagonal shaped "center piece" which can be placed to achieve desired spacing of section lines. The Plexiglas "slot-letter" is a guide which enables draftsmen to do a free-hand lettering job. Lettering is done directly through one of the slots, with the aid of reference lines engraved on the guide to insure proper inclination.

Sickle Blade Sharpener Aids Roadside Mowing

The Edgemaster sickle blade sharpener, manufactured by the Pneu-Hydro Road Machinery Company of Cadillac, Mich., is constructed of 2-inch pipe and heavy gauge steel, with overall dimensions of 4½′ x 8′. Motive power is furnished by a ¼-hp electric motor which drives the grinding wheel at a speed of 3,500 rpm. The wheel is beveled to sharpen two cutting edges at one time. Three clamping devices hold the sickle blade in correct alignment on the table. One man can resharpen a garage's complete supply of cutter blades in a very short period of time—a five-foot mower blade in as little as five minutes.

Bond-O in Ingot Form

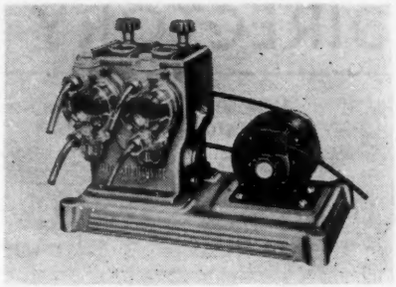
Northrop & Company, Inc., 50 Church Street, New York City, announces that Bond-O self-caulking joint compound for cast iron water mains is now being produced in ingot form as well as in powder form. These Bond-O ingots weigh 10 pounds each and are shipped in 50-pound cartons, 5 ingots to a package. While Bond-O will still be made in powder form, the pig or ingot is easy to store and clean to use.

Economical Sewage Disposal Through Flow Control

A new flowmeter for economical sewage disposal utilizes the basic advantages of the Rotameter metering principle: (1) simplicity (a single moving part); (2) low constant pressure drop; (3) uniformly spaced reading scale; (4) easy adaptability to the most corrosive fluids such as chlorine; (5) accuracy in handling unruly fluids with varying viscosities, densities, and solids content; (6) reasonable cost.
These meters are available for simple flow indication, remote recording, controlling, totalizing or flow ratio controlling. The high flow capacity Rotasleeve which consists of only three parts will handle flows as high as 14,000 gpm of water or 16,000 cfm of air or equivalents in other fluids. Write for Bulletin 45-A which contains a convenient Rotameter recommendation chart. Fischer & Porter Company, Dept. 8R1, Hatboro, Pennsylvania.

Duplex Deluxe Chem-O-Feeder

The Duplex Deluxe Chem-O-Feeder is a new chemical diaphragm type proportioning pump which delivers chemical reagents in an almost continuous stream. It is designed for the positive injection of one or two chemicals at predetermined and adjustable rates and is adapted for many uses including feeding chemicals for water sterilization. The feeding rate of each chemical is individually adjustable for coarse variations by changing the stroking rate through a two-step cone pulley and belt arrangement. For fine variations, a stroke length adjustment knob on top of the Chem-O-Feeder instantly varies the amount of solution fed per stroke. Transparent plastic reagent heads permit observation of vital operating parts while the equipment is in operation. Also, each discharge stroke of the feeder is visible in sight feeder domes and any feeding irregularity may be detected. Moving parts operate in an oil bath. %Proportioneers, Inc.%, 96 Codding Street, Providence, R. I.



Proportioneers Duplex Chem-O-Feeder.

Hydrant Flow Gauge Sets

Northrop & Company, Inc., 50 Church Street, New York City, has resumed the manufacture of new and improved hydrant flow gauge sets with two different types of attached Pitots. These sets are used to determine hydrant discharge measurements and are furnished with properly designed gauges accurate to ½ of 1%. During the war these sets were not available but now they can be obtained upon reasonably short notice. A new circular picturing the different test sets will be mailed upon application to the manufacturer.

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Publications

Pumps.—Sixty types and styles of *vertical and horizontal pumps* manufactured by Peerless Pump Division of Food Machinery Corporation are presented in a new Bulletin (B-136). Types include deep and shallow well pumps, Hi-Lift pumps, and domestic water systems. Copies from the above, 301 West Ave. 26, Los Angeles 31, California.

Manometers.—Bulletin No. 200 describes completely Simplex fixed and portable manometers for use in water surveys and similar flow rate measurement. Also included are valuable engineering data on manometers. A copy will be sent on request to Simplex Valve & Meter Company, 6730 Upland Street, Philadelphia 42, Pa.

Plastiment, a concrete densifier, its action, benefits and uses are described in an excellent 8-page booklet. It is said to improve surface hardness and watertightness of concrete. Sika Chemical Corp., Gregory Ave., Passaic, N. J.

Gasoline Hammers are described in a new folder by Syntron Co., 660 Lexington Ave., Homer City, Pa. These are used as paving breakers, spike drivers, backfill tampers, rock drillers, clay or hard ground spaders, for driving stakes and posts, and similar work. The very low operating cost and the saving possible, even to a small city, are touched on briefly.

Drinking Fountain Memorials.—The Murdock Mfg. Co., Cincinnati 2, Ohio, has issued an instructive folder on outdoor drinking fountains to serve as memorials. A number of attractive installations are shown.

Lighting Obstructions at Airports.—The Airways Lighting Corp., 1836 Euclid Ave., Cleveland, O., has published an excellent 4-page folder on obstruction light stagings for chimneys and similar structures. This is a permanent installation, accepted by the CAA, designed to strengthen chimneys, facilitate all necessary servicing and accommodate illuminated signs. Write for a copy for your files.

"Installing Cast Iron Pipe"—A Sound Movie

This third sound motion picture, produced and made available by Cast Iron Pipe Research Association, is a contribution to good practice in the handling and installation of pipe for underground mains. The picture begins at the pipe yard of a typical foundry; shows the pipe being examined before being loaded on freight cars; illustrates the care exercised in loading, and subsequent unloading onto trucks at the freight station; receipt for delivery in good condition after inspection at the freight station; distribution of the pipe at installation site; trenching operations; and the laying, jointing, inspection, testing, chlorination and backfilling of an actual installation of 8-inch cast iron pipe for a water distribution main. Good practice in the making of lead, sulphur compound and cement joints, as well as in the assembling of mechanical joints, is also shown.

Prints on 16 mm. film are loaned without charge. Arrangements may also be made for a showing with portable projection equipment. Apply to Thomas F. Wolfe, Research Engineer, Cast Iron Pipe Research Association, Peoples Gas Building, Chicago, or to any Sales Office of any company member of the Association.

Ten graduate fellowships, amounting to $1400 each, in traffic engineering, are available at Yale. Closing date for applications is June 1, Write the Bureau of Highway Traffic, Yale University, New Haven, Conn.

News of Equipment Distributors

Ralph L. Johnson and Stuart A Wade have acquired a controlling stock interest in the H. O. Penn Machinery Co., Inc., N. Y., N. Y.

Tri-State Tractor Co., Washington at First St., Albany, Ga., has been appointed distributor in the southern half of Georgia for Buffalo-Springfield rollers, and will handle their complete line.

F. King Paget, 931 Henry Bldg., Seattle 1, Washington, desires to represent American equipment manufacturers in China. Speaks Chinese and some Malay; 30 years experience in the Orient. Will return to China as soon as conditions warrant.

Rene Esteves, Estado 8 Miramar, Santurce, Puerto Rico, desires to represent American equipment manufacturers in Latin America. Engineering training, educated in Puerto Rico and the U. S. Served in the U. S. Army and has just been released with rank of Lt. Col., Corps of Engineers.

John R. Purser, Jr., and John B. London have formed the firm of Purser & London, Inc., and will operate in North and South Carolina as sales engineering representatives for Yeomans Bros. Co. of Chicago.

Sanitation Research Project

As a means toward providing increased health protection to railway passengers and employees as well as the general public, the Association of American Railroads has established a Sanitation Research Project. Under the direction of Abel Wolman, Dr. Eng., Consulting Engineer and Professor of Sanitary Engineering at the Johns Hopkins University, the project will function in collaboration with the Joint Committee on Railway Sanitation, an advisory organization of the Association of American Railroads which has been operating since 1922.

Designed to cover all phases of railway sanitation such as food handling, water supply and treatment and disposal of wastes on railway cars and in terminals, the first objective of the

project is the development of a sanitary means for the handling and disposal of toilet wastes from passenger-carrying cars.

Dr. Wolman's principal assistants are: Lloyd K. Clark, Project Manager, former director of the Division of Sanitary Engineering of the North Dakota State Health Department; and William A. Hazlett, Mechanical Engineer, formerly employed by the Bethlehem Steel Company as Test Engineer in the Mechanical Department. Both Clark and Hazlett have been recently relieved from active duty with the Army as Lieut. Colonel and Captain respectively. Offices and laboratories are located at 1103 West Pratt Street, Baltimore 23, Md. (Mt. Clare Shops of the Baltimore and Ohio Railroad.)

Jobs Available for Engineers

The Sanitary Corps needs about 14 sanitary engineers and 6 entomologists for overseas assignments due to the poor response on the part of war-time personnel to remain in the Pharmacy or proposed Medical Service Corps. Applicants for active duty must sign to remain in the Army until at least June 30, 1947, and must be willing to serve overseas; must have an efficiency index of at least 40; must be a reserve or National Guard officer; and must return to duty in the rank held prior to separation—that is the separation or consolation promotion will not count. Also he will be subject to any general army downward grade revision, but can not be reduced to a rank lower than he held on Dec. 7, 1941. Application should be made to the Adjutant General; Attention "Officers Branch" if he has 16 days or more unexpired terminal leave; or "Reserve Branch" if less than 15 days leave remain or if relieved from active duty. (See ASF Cir., 82, April 1.)

U.N.R.R.A. needs 15 to 20 engineers for foreign assignments; salary range $4000 to $6000, plus maintenance. Write Maj. F. F. Aldridge, 1523 New Hampshire Ave., N. W., Washington, D. C.

The Corps of Engineers requires skilled sanitary engineers for duty on a civilian status in the Pacific, primarily in or near Manila or on Okinawa. One P-5 is needed ($6475), one P-4 ($5375), and four P-3 ($4550). The rates shown allow for differential for overseas service; there are no other allowances. Applicants must generally have 10 years of good experience for the highest grade and 9 and 7 years for the others; must generally be under 50 years of age. Write Brig. Gen. L. D. Worsham, Office of The Chief of Engineers, War Dept., Washington, D. C.

A Metropolitan County Sanitary District in Pennsylvania needs one man with experience and training in industrial waste chemistry to take charge of industrial waste studies; salary $5000. Also two sewer designers at $4000; and two laboratory chemists for routine sanitary work at $4000. Must be college graduates and capable men. Include brief summary of training and experience in first letter. Write to Col. Hardenbergh of this magazine who will forward applications.

A consulting engineer in upper New York State needs 2 or 3 men with some experience in sewage treatment plant design, salary $200 to $250 per month. Write Col. Hardenbergh, this magazine, who will forward all letters.

Two civilian technicians are needed by the *Engineering Board, Ft. Belvoir, Va.* Salary range $4,600-$5,400. One must be experienced in highway engineering and equipment, and one in soil stabilization and compaction. Write Lt. Col. G. B. Schoolcraft, at above address.

Indiana State Board of Health needs several junior sanitary engineers, grade II classification. Write B. A. Poole, Director, Division of Environmental Sanitation, 1098 West Michigan St., Indianapolis 7, Ind.

Men with *mosquito control experience,* sanitary engineers or entomologists, for supervising work in Virginia. Starting salary about $2,600. Write R. E. Dorer, Essex Bldg., Bank & Plume Sts., Norfolk, Va.

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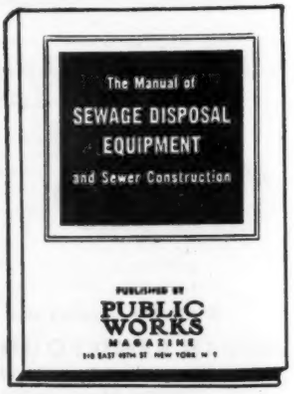

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2. Jaeger air compressors, made in sizes 60 to 500 cu. ft.; trailer, truck, tractor and stationary mounted, gas, Diesel and electric power. Catalog and data. The Jaeger Machine Co., 400 Dublin Av., Columbus 16, O.

Bins and Batching Plants

11. Good illustrations and useful data on all types of Heltzel Highway Bins, for truck mixer charging, bulk cement plants, enclosed bucket elevators, belt conveyors, etc. Heltzel Steel Form & Iron Co., Warren, O.

Resurfacing Plants

15. Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus 16, Ohio.

16. Moto-paver is a new type self-contained travelling asphalt plant having a capacity of 100 to 120 tons per hour. A novel spreading and laying device permits quick change to various road widths and crown conditions and thicknesses. Write Hetherington & Berner, 729 Kentucky Ave., Indianapolis 7, Ind. for Bulletin MP46 which gives full descriptions and specifications.

Concrete, Early Strength

38. 64-page manual tells how to speed concreting, to secure high early strength and greater workability at temperatures either below or above freezing. 60 photos, charts, graphs and tables. Calcium Chloride Assn., Penobscot Building, Detroit 26, Mich.

Concrete, More Durable

50. How cement dispersion assures improved concrete with impressive economies in initial construction costs and maintenance costs. Manual from The Master Builders Co., 7016 Euclid Ave., Cleveland 3, Ohio.

Drainage Products

70. Standard corruguated pipe, perforated pipe and MULTI-PLATE pipe and arches — for culverts, sewers, subdrains, cattlepasses and other uses. 48-page booklet, No. 12. Armco Drainage Products Association, Middletown, Ohio.

72. New data on clay pipe is contained in literature offered by National Clay Pipe Manufacturers Inc. Address them at 111 W. Washington St., Chicago 2, Ill.

Forms, Curb and Gutter

78. Curb and Gutter and Sidewalk Forms, including battered face curb form especially for modern traffic conditions. Heltzel Steel Form & Iron Co., Warren, O., will send booklets on request.

Generators

80. Two portable generators, one for AC and the other for DC current are described in new bulletin issued by Homelite Corp., Port Chester, N. Y. Commonly used for operating electrical equipment in planes, tanks and trucks, or to charge batteries or to supplement batteries for starting main engines, etc.

Graders, Patrol

98. The Austin-Western 99M Power Grader with its powerful all wheel drive handles difficult jobs with economy and efficiency; and does better work on grading, ditching, scarifying, snow ploughing, loading, mixing, bulldozing, shoulder trenching and backsloping. Write for Bulletin 1946. Austin-Western Co., Aurora, Ill.

Joints, Expansion

102. Para-Plastic hot-poured rubber joint sealing compounds and Asphalt, Fibre, Cork, Cork-Rubber, Sponge Rubber and Waterstop expansion joints are described and illustrated. Write Servicised Products Corporation, 6051 W. 65th St., Chicago 38, for a copy.

Memorial Plaques

106. Honor rolls, memorials, sculptured bas-reliefs, plaques, tablets, name plates and letters of bronze are illustrated and described in folder sent on request to Architectural Bronze & Aluminum Corp., 2342 W. Belmont Ave., Chicago 18, Ill.

Mud-Jack Method

107. How the Mud-Jack Method for raising concrete curb, gutter, walls and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee 10, Wis.

Paving Breakers

110. Powerful self-contained gasoline hammers illustrated. Used as paving breakers and spike drivers. Easily portable, economical. Write Syntron Co., Box 220, Homer City, Pa.

Paving Materials, Bituminous

111. New "Tarvia Manual" is packed with useful data on how to build and maintain roads with Tarvia. Each step is illustrated with excellent action pictures, 64 pp. 103 illus. Write to The Barrett Div., 40 Rector St., New York 6, N. Y.

Piling, Steel

112. Illustrated descriptions of both standard and interlock corrugated steel sheet piling of minimum weight, maximum strength, ease of handling with methods of installation are contained in a booklet. If you have a job involving piling write Caine Steel Co., 1820 N. Central Ave., Chicago 39, Ill.

Pumps

117. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

121. "Sure prime" portable pumps—the full line—describing certain special features for all-weather service, are described in Catalog P-45, to be had by writing The Jaeger Machine Co., Columbus, Ohio.

Road Building and Maintenance

126. Two and Four Wheel Scrapers, Bulldozers, Tamping Rollers, Winches, Hoists and Repair Towers are subject of special bulletins issued by Gar Wood Industries, 7924 Riopelle St., Detroit 11, Mich.

128. Two powerful Galion motor graders designed to answer every requirement for more speed in road, airport, dam and housing construction work are fully described in a folder illustrated with many action pictures. Issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

130. BG Maintainer, a powerful speedy, low-priced machine for light road maintenance. Write for folder, Huber Mfg. Co., Marion, Ohio.

Rollers

141. Three-Wheel and Tandem Rollers, 5 to 8-ton and 10 & 12 ton sizes: also variable weight tandem roller for new highway surfacing and old road conditioning. Huber Mfg. Co., Marion Ohio.

Soil Stabilization

150. "High-Service, Low Cost Roads" sets forth the principles and advantages of road surface stabilization with calcium chloride. Complete, interesting and well illustrated, 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

152. Complete information dealing with Calcium Chloride Stabilized Roads. Contains many charts, tables and useful information. Write Columbia Chemical Div., Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh 19, Pa.

154. "Soil Stabilization with Tarvia" —An illustrated booklet describing the steps in the stabilization of roadway soil with Tarvia will be mailed on request by The Barrett Division, 40 Rector St., New York 6, N. Y.

Spreader

187. Mix-in Place Roadbuilders, Bituminous Pavers, Concrete Bituminous Finishers. Adjustable Spreaders, Forms, etc. —4 complete catalogs in one cover, issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus 16, Ohio.

Surface Consolidation and Maintenance

188. How sub-soils can be conditioned to resist softening and frost-action; how surfacing can be consolidated to provide smooth all-weather riding surfaces; how they can be maintained so as to prevent disintegration and gravel loss. Write the Calcium Chloride Association, Penobscot Bldg., Detroit 26, Mich., for Bulletin No. 29.

Tractors

190. International Diesel Tractors are described and many uses mentioned in 48-page catalog. Write International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

192. Little Giant Tractor Sweepers for streets are described in illustrated bulletin. Especially designed to meet the needs of smaller cities and towns. Address: Little Giant Products, Inc., 1554 N. Adams St., Peoria 3, Ill.

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Street .....

City ..... State .....

Winches

200. 1-, 2-, 5-Ton Little Giant Hand Winches take the labor out of any heavy operation. Outstanding design and construction. Address: Little Giant Products, Inc., Peoria 3, Ill.

Maintenance Equipment

290. "Blacktop Road Maintenance and Construction Equipment" — Asphalt and tar kettles, flue type kettles, spray attachments, tool heaters, surface heaters, road brooms and rollers. This is modern and up-to-date equipment for blacktop airport and road construction and maintenance. Write for Catalog R. Littleford Bros., Inc., 452 East Pearl St., Cincinnati 2, Ohio.

Fire Apparatus

305. Eight page catalog, "Fire-Fighters," describes in detail, the Carter "Chief" and Carter "Warden" fire-fighters. These units manufactured in both the stationary and portable types are self-priming and have official underwriters approval. Address Ralph B. Carter Co., Hackensack, N. J.

Snow Fighting

Snow Plows

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

Ice Control

354. Ice Prevention on Highways, Streets, and Airport Runways with Sterling "Auger Action" Rock Salt. An illustrated bulletin issued by International Salt Co., Inc., Scranton, Pa.

Sanitary Engineering

Air Release Valves

357. Automatic Air Release Valves for water, sewage and industrial uses are described and illustrated in new catalog issued by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia 42, Pa.

Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

Activation and Aeration

367. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability, 20 pp. illustrated. Sent on request to Norton Company, Worcester 6, Mass.

Bodies, Refuse

375. Gar Wood special bodies for sanitary refuse collection and for street sprinkling are illustrated and described in a new catalog issued by Gar Wood Industries. 7924 Riopelle St., Detroit, Mich.

Cleaning Sewers With Own Forces

385. A 20-page booklet describes and illustrates a full line of sewer cleaning equipment—Rods, Root Cutters, Buckets, Nozzles and Flushers. Write W. H. Stewart (Pioneer Mfr. since 1901), Jacksonville, Fla., or P. O. Box 767, Syracuse, N. Y.

386. 32-page illustrated booklet explains how a city can clean its sewers and culverts with its own forces using the up-to-date Flexible Sewer Rod equipment. Illustrates and describes all necessary equipment. Issued by Flexible Sewer Rod Equipment Co., 9059 Venice Boulevard, Los Angeles 34, Calif.

Corrosion Prevention, Water Tanks

389. For all water tank maintenance troubles, whether the need is for repairs, painting, welding, or cleaning, get latest literature of Chicago Tank and Bridge Co., 618 Empire Bldg., Rockford, Ill.

390. "Preventing Corrosion of Steel Water Storage Tanks" is the subject of an interesting, illustrated bulletin issued by Electric Rust-Proofing Corp., Dayton 10, Ohio. Gives full description of Rustop System of prevention.

Corrosion Resistant Metal

391. "Everdur Metal" is title of an 8-page illustrated booklet describing advantages of this corrosion-resisting alloy for sewage treatment equipment, reservoir, and waterworks service. The American Brass Company, 25 Broadway, New York.

Diesel Engines

393. Small Diesel engines—down to 3¾ HP. The only stationary Diesel that is air-cooled. For full details on this revolutionary engine for municipal service write R. H. Sheppard Co., 150 Middle St., Hanover, Pa.

394. "Blue Streak" engines for 425 and 495 hp are described in Bulletin No. S 329; also Bulletins SA 341 and 342 for small and medium power service. Write Climax Engineering Co., 111 W. Monroe St., Chicago, Ill.

Feeders, Chlorine, Ammonia and Chemical

399. Feeders of all types including Hypochlorinators, Reagent Feeders, Dry Chemical Feeders, Chlorinators and Ammoniators for feeding all of the usual chemicals used in sanitation practice—manufactured by Wallace & Tiernan Co., Newark 1, N. J.

400. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers, Inc. %, 96 Codding St., Providence 1, R. I.

401. Gravimetric Feeder, Loss-in-weight type, measures and feeds dry or liquid materials by weight. Illustrated bulletin. Omega Machine Co., Inc., 96 Codding St., Providence 1, R. I.

Filters, Sludge

403. For bulletins on Vacuum Filters for dewatering primary, activated, digested or chemical sludge, write The Conkey Co., 420 Lexington Ave., New York 17, N. Y.

Fire Hydrants

405. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Anniston, Ala.

Flow Meters

409. The primary devices for flow measurement—the orifice, the pitot tube, the venturi meter and others—and the application to them of the Simplex meter are described in a useful 24-page booklet (C42A). Simplex Valve and Meter Co., 6750 Upland St., Philadelphia 42, Pa.

Gas Engines

411. For information on the use of Climax engines with sewage gas for developing power around the sewage plant write Climax Engineering Co., 111 W. Monroe St., Chicago, Ill.

Gas Holders

412. A 16-page bulletin gives detailed information on the development of corrosion—and how to combat it—in gas holders. A copy will be mailed on request to The Stacey Bros. Gas Construction Company, 5535 Vine St., Cincinnati 16, Ohio.

Gates, Valves, Hydrants

413. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

Generating Sets, Diesel

420. Le Roi engine-generator units for operating on "no cost" sewage gas are fully described and illustrated in new bulletins now available. Address Le Roi Co., 1726 S. 68th St., Milwaukee 14, Wis.

422. New booklet describes Sheppard Diesel Generating Sets that make low cost electricity from cheap fuel and give dependable service in the hands of any average operator. Write R. H. Sheppard Co., 250 Middle St., Hanover, Pa.

Laboratory Equipment

423. pH and Chlorine Control. A discussion of pH control and description of comparators, chlorimeters and similar devices. An 80-page booklet, W. A. Taylor & Co., 7301 York Road, Baltimore 4, Md.

425. "Replaces 'old fashioned' Methyl Orange Indicator" is sub-title of new folder on pH control by new Fleisher Methyl-Purple Indicator. Sharp, clear and positive end points of green and purple insures more accurate and quicker results. Issued by Fleisher Chemical Co., Benjamin Franklin Station, Washington 4, D. C.

Leak and Pipe Location

427. For tracing buried pipes and finding hidden leaks get detail of Allen-Howe Leak Detectors, Pipe Locators, Dipping Needle and Pipe Phones. Write Allen-Howe Electronics Corp., 150 Main St., Peabody, Mass.

Manhole Covers and Inlets

429. Street, sewer and water castings in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., Lafayette Boul, and Indiana Ave., South Bend 23, Ind.

Meter Setting and Testing

431. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

Meters, Venturi

432. New bulletin illustrates Builders Air Relay system for liquids containing suspended solids like sewage. Eliminates corrosion, clogged pipes, etc. "The Selection of Main Line Meters," a highly informative and useful presentation, describes forms of differential producers and quickly solves typical problems with the use of graphic charts. Write Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.

Pipe, Cast Iron

437. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

438. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Pipe Forms

440. Making concrete pipe on the job to give employment at home is the subject of a booklet sent promptly on request by Quinn Wire & Iron Works, 1621 12th St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms.

Pipe, Lock Joint

442. Lock Joint Reinforced Concrete Sewer Pipe, Pressure Pipe, Culvert Pipe, Centrifugal Pipe and Subaqueous Pipe is described and illustrated in bulletins available from Lock Joint Pipe Co., Ampere, N. J.

Pipe Pusher

444. One-man-operated Hydraulic Pipe Pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts and prices, ask for booklet S-117, Greenlee Tool Co., 2042 Columbia Ave., Rockford, Ill.

Pipe, Transite

445. Two new illustrated booklets. "Transite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., 22 East 40th St., New York 16, N. Y.

Pipe Joint Compounds

450. The uses of Tegul-Mineralead for bell and spigot pipe and G-K Sewer joint compound are described in a 16-page illustrated booklet issued by Atlas Mineral Products Co., Mertztown, Pa. Includes useful tables for estimating quantities needed.

Pumps, Sludge

453. Specialized pumps for sewage, sludge, water supply, circulation, condensation. Vertical, horizontal, centrifugal units. A separate bulletin for each type. Request bulletins by type of pump from Yeomans Brothers Company, 1425 North Dayton Street, Chicago 22, Illinois.

Pumps and Well Water Systems

454. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Advertising Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis 8, Tenn.

455. Peerless deep well pumps in a variety of types, with oil or water lubrication and any power drive, to pump water from any depth. Write Peerless Pump Div., Food Machinery Corp., 301 W Ave. at 26th St., Los Angeles 31, Calif.

456. Oil lubricated turbine pumps with open impellers. Five types of heads available. Specifications and illustrations in new bulletin 6930M-2 issued by Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Ill.

457. Centrifugal Pumps of various designs—single-stage, double-suction, split casing; single-stage single-suction; two-stage opposed impeller; three-stage; high-pressure; fire pumps; close-coupled. A bulletin for each type. Peerless Pump Div., Food Machinery Corp., Quincy, Ill.

Rubbish Collection

459. For saving trucks, labor, and time in city rubbish collection get details of the new Dumpster-Kolector described in literature just published by Dempster Brothers, Inc., Knoxville 17, Tenn.

Screens

460. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and inclined types). Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

Sludge Drying and Incineration

462. "Disposal of Community Refuse by Incineration" is a handsome 34-page booklet that discusses incineration from a commonsense standpoint. Illustrated by numerous photos of typical installations and includes diagrammatic outlines of various plant designs. Write Morse Boulger Destructor Co., 207-P East 42nd St., New York 17, N. Y.

463. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebusters for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

Softening

467. Water Softening. The use of the Spaulding Precipitator to obtain maximum efficiency and economy in water softening is described in a technical booklet. Permutit Co., 330 W. 42nd St., New York 18, N. Y.

Sprinkling Filters

469. Design data on sprinkling filters of Separate Nozzle Field and Common Nozzle Field design as well as complete data on single and twin dosing tanks, and the various siphons used in them, for apportioning sewage to nozzles. Many time-saving charts and tables. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

Swimming Pools

472. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Taste and Odor Control

474. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark 1, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination. Sent free to any operator requesting it.

475. "Taste and Odor Control in Water Purification" is an excellent 92-page, illustrated booklet covering sources of taste and odor pollution in water supplies and outlining the various methods of treatment now in use. Every water works department should have a copy. Write Industrial Chemical Sales Div., 230 Park Ave., New York 17,, N. Y.

Treatment

476. Are you familiar with the new, revolutionary "Rim-Drive" Clarifier? "Rim-Drive" eliminates costly mechanism and installation, and reduces maintenance costs. Write Yeomans Brothers Company, 1425 North Dayton Street, Chicago 22, Illinois, for the complete design details, capacities and installation illustrations.

477. The Yeomans "Package" Aerifier" plant is especially designed for communities up to 3,000 population. This attractive, efficient plant, which features mechanically combined aeration and final clarification in a single tank, is described in Bulletin 6650. Write Yeomans Brothers Company, 1425 North Dayton Street, Chicago 22, Ill.

478. Carter Mechanical Mixing Equipment is described in bulletin #4501. Recently issued, this catalog illustrates in detail, the various mechanical mixing mechanisms for water, sewage, and industrial waste treatment manufactured by the Ralph B. Carter Co., Hackensack, N. J.

480. Booklet No. 1642 on Link-Belt Circuline Collectors contains sanitary engineering data and design details. Catalog No. 1742 on Straightline Collectors, contains layout drawings, installation pictures and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia 40, Pa.

482. "Sedimentation with Dorr Clarifiers" is a complete 36-page illustrated catalog with useful design data. Ask The Dorr Company, 570 Lexington Ave., New York 22, N. Y.

486. 28-page catalog describes and illustrates the Dorrco Hydro-Treator, a self-contained water treatment unit combining Flocculation, Sludge Thickening and Clarification. Reduces treatment time and lowers plant construction costs. The Dorr Co., 570 Lexington Ave., New York 22, N. Y.

488. "Packaged" Sewage Treatment Plants specifically developed for small communities — 100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 2438 Wolfram St., Chicago 18, Ill.

490. New bulletin fully describes and illustrates Hardinge sludge collectors for clarifiers, sludge concentration and skimming in both circular and rectangular tanks. Write Hardinge Company, Inc., York, Pa.

Underdrains, Trickling Filter

492. Illustrated bulletin describes the Natco Unifilter block of glazed, hard burned clay for underdraining filter beds. Write National Fireproofing Corp., Pittsburg 12, Pa., for free copy.

Water Treatment

496. "Use of copper sulphate in water treatment plants" contains valuable data on chemicals, dosage, etc. Ferri-floc Ferric Sulphate—a new, valuable booklet on coagulation for water and sewage treatment plants. Write Tennessee Corporation, Atlanta 1, Ga.

502. Alum for coagulation in both sewage and water plants is the subject of literature now available from General Chemical Company, 40 Rector St., New York 6, N. Y.

503. Get your illustrated booklet now on *Pittchlor*, a high test calcium hypochlorite, containing minimum 70% of available chlorine. Address, Pittsburgh Plate Glass Co., Columbia Chemical Div., 5th Ave. at Bellefield, Pittsburgh 13, Pa.

Water Service Devices

506. Data on anti-freeze outdoor drinking fountains, hydrants, street washers, etc., will be sent promptly on request to Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati 2, Ohio.

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News of People

C. E. Jones, who served as Major, Corps of Engineers, has been appointed Sales Development Manager of the Caterpillar Tractor Co.

Frank C. Roe, widely known sanitary engineer, has been appointed Eastern Field Manager, Sewage Equipment Division, Chicago Pump Co., with office at 79 Madison Ave., New York. Mr. Roe for the past 14 years has been development engineer and manager of porous product sales for Carborundum Co.

Dan K. Heiple has returned after three years service in the Navy to R. G. Le Tourneau, Inc., Peoria, Ill., to serve as field engineer.

Guy E. Griffin has been released from the Army after 4½ years of service with the Corps of Engineers and the Sanitary Corps, and has been appointed Associate Chief of Field Party and Chief Engineer for the Institute of Inter-American Affairs in Honduras. Col. Griffin recently returned from the Pacific.

B. P. Spann has returned to Gardner-Denver Co. as advertising manager after 38 months service in the Navy, during which he rose to the rank of Lt. Commander.

J. Mitchell Fain, former Colonel of the AAF, has rejoined the staff of Foster D. Snell, Inc., consulting chemists and engineers, Brooklyn 1, N. Y.

Charles E. Wilson, vice-president of the Worthington Pump & Machinery Corp., has been elected president of the Worthington-Gamon Meter Co.

Charles J. Knoener has rejoined the Pitometer Co. after 3½ years in the navy, from which he was recently released with the rank of Lt. Commander.

R. C. Owens has returned to his position as Secretary to the Osgood Co. and the General Excavator Co., both of Marion, O., after nearly 3 years of service as an officer in the Navy.

Fred A. Eidsness, Southeast District Manager for Infilco, Inc., has moved his headquarters to 215 Church St., Decatur, Atlanta, Ga.

T. W. Boyle has been appointed district manager for the sale of all Heil Co. products in 5 states, with headquarters in Board of Trade Bldg., Kansas City, Mo.

W. W. Towne, Major Sn. Corps, has returned to his pre-war position as director of the Division of Sanitary Engineering, South Dakota State Board of Health. Major Towne, who served in Panama, Hawaii and the Philippines, was one of the outstanding officers of the Sanitary Corps. Also returned to Maj. Towne's organization are: *Capt. E. R. Mathews,* Sn. C., from Burma and India; *Capt. R. G. Spieker,* Sn. Corps; and *Lt. T. B. Evans,* USNR.

R. L. Johnson, Capt. Sn. C., has been appointed Sanitary Engineer for Link-Belt Co., Philadelphia.

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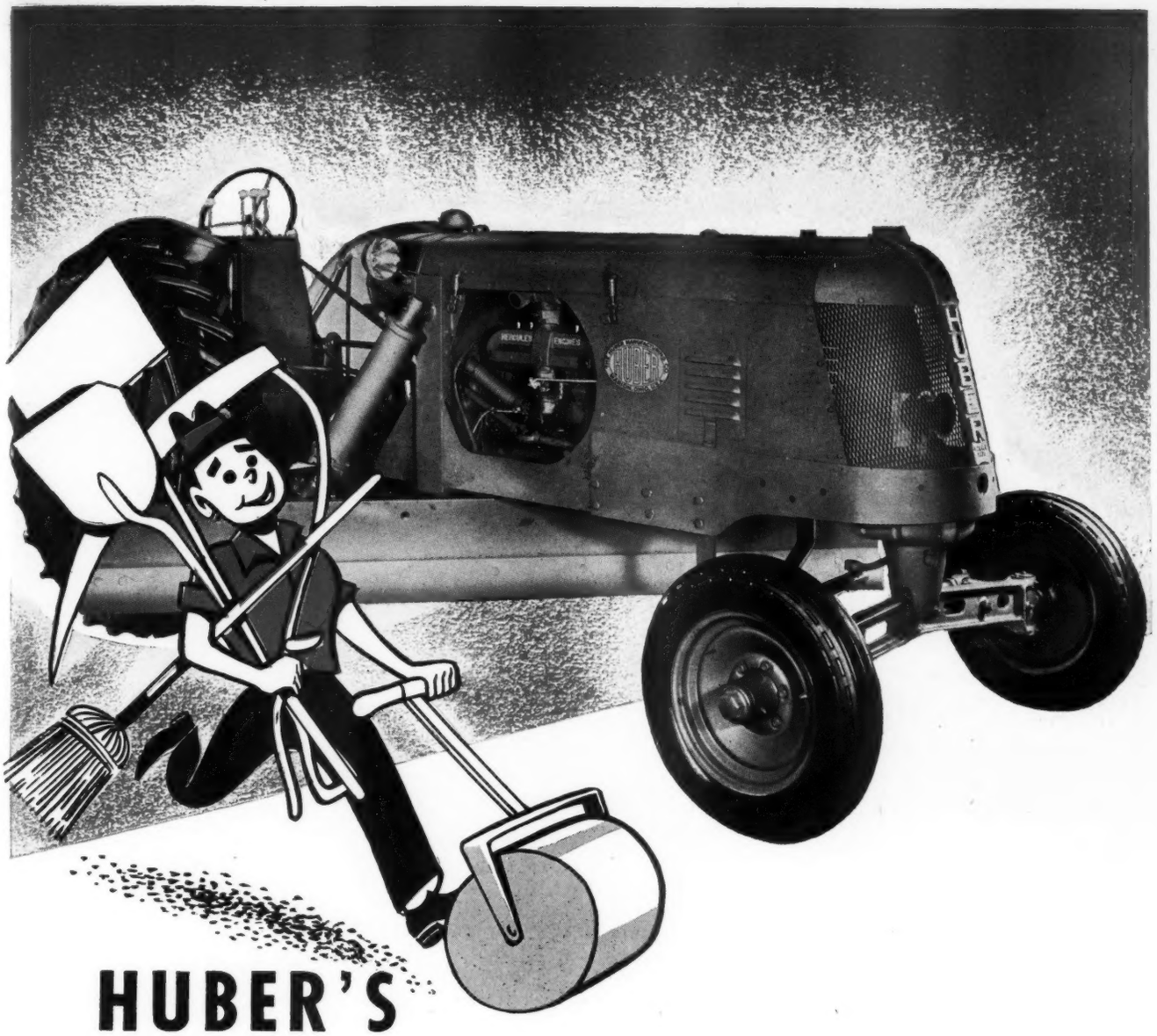

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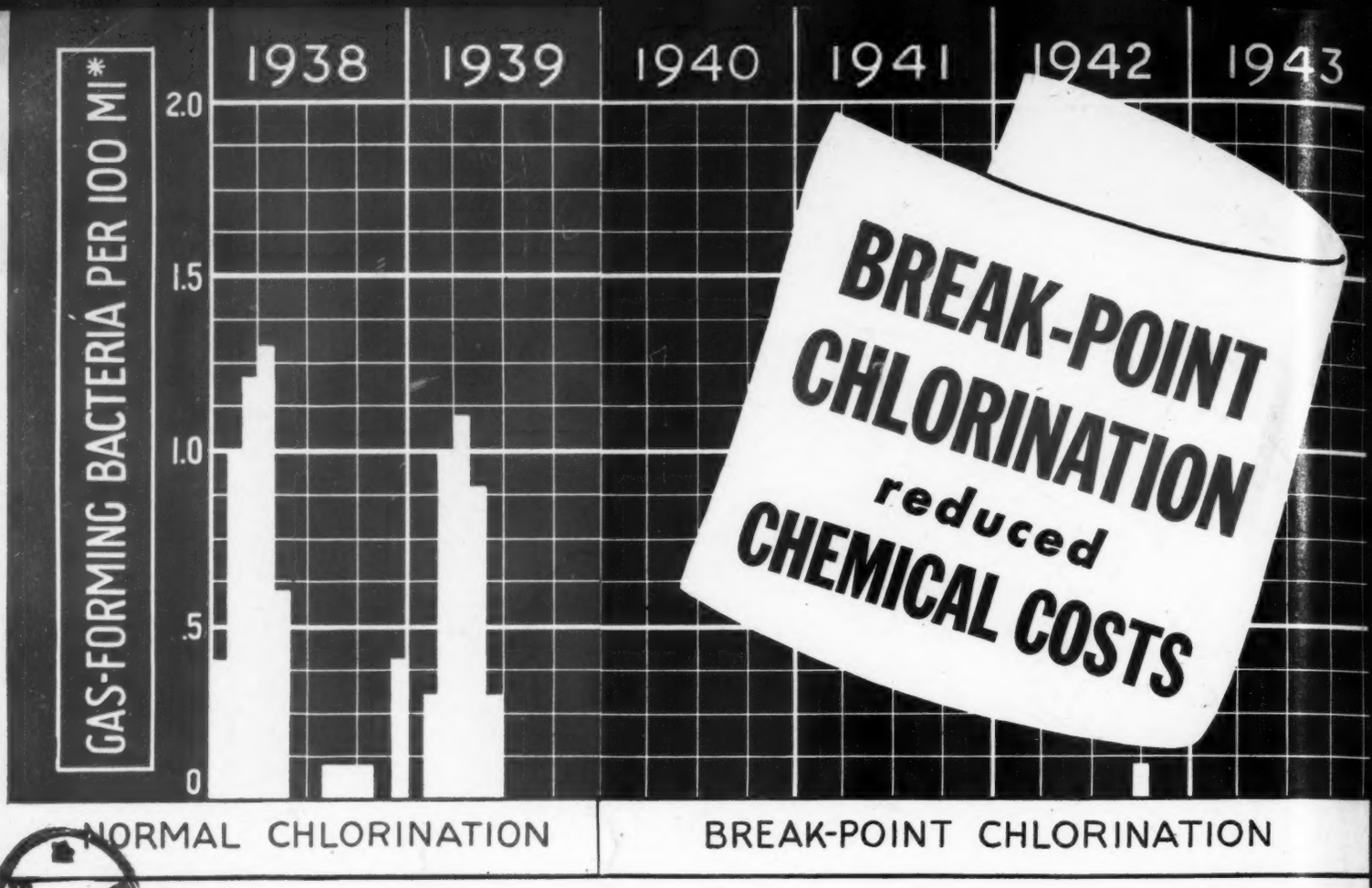

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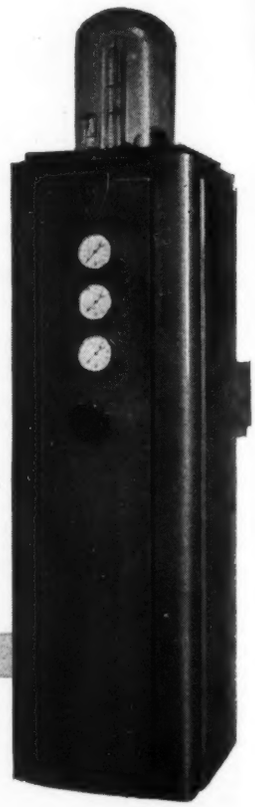
BACTERIOLOGICAL DATA

	NORMAL CHLOR.	B-P CHLOR.	CHANGE
Total Bact. per ml (avg.)			
Raw	588	399	−32.1%
Filtered	1	1	0
Finished	1	1	0
I.N. (Indicated Number) Gas-Forming Organisms per 100 ml			
Raw	70.00	63.07	− 7.0%
Filtered	.89	.02	−97.7%
Finished	.38	.003	−99.2%



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